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ABSTRACT

An interdisciplinary design project report investigates the relationship of the fifth grade educational facility to the student and teacher needs in light of human and environmental factors. The classroom, activity and teaching spaces are analyzed with regard to the educational curriculum. Specifications and design criteria concerning equipment and the environment are established along with building structure and classroom arrangement details. A design synthesis is given showing the interaction of curriculum, classroom areas and equipment. Storage, furniture, audiovisual and other equipment design recommendations are given to support investigation findings. Drawings, floor plans, and interaction nets are included. (TG)

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THE FIFTH GRADE CLASSROOM

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THE FIFTH GRADE CLASSROOM

RESEARCH IN EDUCATIONAL FACILITIES DESIGN

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PREFACE

The purpose of this project was to perform an in-depth investigation of a given area of educational facilities which would include the relationship of the environment to student and teacher needs. Educational theories and practices, state-of-the-art information, and unique problems in the environment would be considered by the investigators. The output of the investigation was to include recommendations for practices and environmental specifications as well as the development of specific illustrative examples, representing advanced developments in educational facilities. The designers were cautioned to remain within the realistic limits of technologically feasible resources and current developments in educational theory and practice.

The staff for this project which was drawn from the Environmental Design Center and the Center for Educational Research Services included D. Michael Murtha, Design Programmer; Michael Hartman, Architectural Designer; Roger Kramer, Interior Designer; John Thomson, Industrial Designer; and John Proctor, Educational Specialist. Advisory and supervisory assistance was provided by Philip M. Bennett, coordinator at the Environmental Design Center for the Clearinghouse on Educational Facilities; and Dr. Darell Boyd Harmon, Special Lecturer at the Environmental Design Center and Specialist in Educational Facilities. Special consultants were Byron Bloomfield, Director, Environmental Design Center; and Dr. Howard Wakefield, Director for the Clearinghouse on Educational Facilities.

Information for this project was obtained from reviews of the educational literature, reports processed by the Clearinghouse on Educational Facilities, and remarks from specialists in education and visiting lecturers. The educational specialist on the team provided a great deal of general background and orientation and information on special problems in education throughout the project. Additional information was derived from materials of a more general nature developed by the Environmental Design Center and from human factors literature.

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INTRODUCTION

The construction, furnishing and eventual utilization of a classroom in an elementary school requires much planning by many people of vastly different backgrounds. The concern of this paper is the design of an educational facility. In addition to the presentation of a design solution, much comment is offered on methodology. An extensive examination of the factors affecting design was made. Educational goals and the ensuing curriculum were hypothesized on the basis of the social, physical and emotional development of the child. Design function was first generalized and then applied specifically to a mythical fifth grader. The following discussion will include the factors which were identified and a design solution resulting from the synthesis of these factors.

DEFINING THE PROBLEM

In selecting an area of the educational environment for detailed examination, it was necessary to find one of both general application and of relatively little prior coverage. This criteria was satisfied by the fifth grade which contains many of the attributes common to grades both above and below it, but which has in the past received less coverage than early elementary and secondary education. In addition, since the fifth grade serves in many ways as a transition between the acquisition and application of learning skills, there are sufficient design problems of unique interest to justify investigation. Finally, although patterns of education may change in the future, the fifth grade seems to contain enough essential elements of both social and educational development to insure its incorporation in one form or another into future programs of education.

Within this context, facilities for the fifth grade may be narrowed to the classroom which, under present practices, contains most of the wide range of teaching functions, specialized support facilities being used when available. The problem is further defined by class interrelationships, such as team-teaching, which indicate consideration of multiple sections or suites of rooms. The final constraint of an average of twenty-five students per room is strongly indicated by present practice and economics.

DESIGN INNOVATION

A project was established within the ERIC system to provide a state-of-the-art or current summary of materials relating to the design of educational facilities for fifth grade instruction. Within this scope, the discussion and solution are based on the best of current practice rather than attempting to predict future developments in the field of education and educational facilities. Although this synthesis may reach beyond current practice in any one school, the intent is to remain within the bounds of current capabilities in teaching and technological innovation so that the working model may find application in present design solutions.

THE INTERDISCIPLINARY TEAM

An interdisciplinary team, possessing various design backgrounds as well as strengths in education, physiology and psychology, provided the necessary expertise to synthesize currently available information. Graduate students from the University's Environmental Design Center with specialities of architecture, interior design, product design and design programming joined a former elementary school principal in the development of educational and design specifications.

THE DESIGN PROBLEM

Specifications: The fifth grade classroom considered in this study is a general compilation rather than the solution for any specific location or situation. Consequently there were few external limitations imposed upon the design. The problem was rather to develop the solution criteria from the available information about fifth grade students, teaching, and curriculum. This involved an intensive investigation of background material related to education. A typical curriculum was developed based on that in the Madison, Wisconsin, public schools. Current literature on design was abstracted from the Clearinghouse on Educational Facilities. Guest experts were brought in to discuss criteria for design.

Design: With this background information on elementary education, the task of the design team was to develop specifications for the educational facilities based upon the curriculum, task classification and analysis, and educational and human factors limitations. These criteria were then synthesized in the development of a general solution, with specific details worked out by members of the interdisciplinary team. An overview of the educational specifications leads into the development of the structural design as well as the design of classroom equipment.

EDUCATIONAL DEVELOPMENT

INTRODUCTION

The investigation of educational background information provided data relevant to the educational process which have direct bearing to design, such as physical and behavioral development of the student, educational objectives and the ensuing curriculum, and the educational specifications for the architect.

PHYSICAL DEVELOPMENT

The student, particularly in the elementary years, is constantly growing. This produces changes and needs which affect the design of the educational environment. Some of these factors include:

Large Muscle Development: The student is reestablishing the use of large muscles, requiring activities centered around coordination and good posture.

Motor Skills: The student is developing motor skills including: balance, eye-hand coordination, rhythm, etc. He requires the use of balance boards, walking rails, easels, points for orientation, etc.

Fatigue: The student is physically active, requiring freedom of play and movement, but he is also easily fatigued by physical activities and requires frequent changes of activity and rest to avoid fatigue.

Growth: On the average a ten year old girl weighs 68 pounds and is 54 inches tall, while a boy weighs 70 pounds and is 56 inches tall; however a major growth spurt occurs from 10 to 13 years, producing wide variations.

BEHAVIORAL DEVELOPMENT

While the student's body is maturing physically, his social and educational behavior is also being formed as the result of his experiences.

Social Groups: Children need to associate with peer groups as a source of recognition and approbation. Their role as part of a group aids in understanding and practicing desirable social relationships and in developing communication skills. It is important that the group members be free to choose their own groups and leaders and choose their own tasks.

Self-Realization: Self-realization based on independence, self-reliance, and self-government, is necessary in order that the student can gain satisfaction from the ability to achieve, with opportunities for making decisions and facing the consequences of those choices.

Skill Development: The students need freedom to work on developmental tasks, including continued acquisition of the basic learning tools, application of these tools to problems which they face, and the increased use of resources in the school and community.

Use of Empirical Data: Students are concerned with the real world--formulating hypotheses and gathering data appropriate to the testing of these hypotheses seeking reality and factual information, collecting, sorting, and classifying, looking for proof and cause-effect relationships.

EDUCATIONAL OBJECTIVES

The major factor in determining fifth grade education is the conception of the student in the transitional phase from the development of learning skills and information in the early grades to application of these skills and principles in the later grades. Within this context, the educational objectives for the fifth grader may be given as stated by Dewey: (1) personal efficiency, (2) social efficiency, and (3) economic efficiency. These can be restated at this grade level within the concept of self-actualization of the child, defined as follows:

1. Developing to the fullest extent intellectual, physical, and social skills.
2. Developing aesthetic appreciation.
3. Building a sense of ethics and responsibility.
4. Developing skills of communication for use within and without the social environment.

FIFTH GRADE CURRICULUM

Within the developmental needs of the child and the educational objectives, the curriculum or subject material can be developed as a part of the student's progression through the educational process. The curriculum is the major factor in determining the educational facilities needed since it implies the activities to be conducted in the environment. The curriculum presented below is based on the Madison, Wisconsin, public schools and is used as a framework for defining common, current practice in the field.

Mathematics: The mathematics program includes the study of number theory, problem solving, measurement, fractions and decimals, geometry and graphic representation. Activities involved in this study include writing problems on paper, on the chalkboard, or with the use of an overhead projector; reading texts and viewing films; demonstration of or drilling with flashcards, chalkboard, models, charts, etc.; and individual correcting by the teacher.

Science: Science units reinforce earlier science programs in prior grades. Topics include the Earth, Universe, Living Things, Matter and Energy. Much of the time is devoted to experiments related to the area being studied, making use of a range of activities such as heating materials over a bunsen burner, planting seeds, making a volcano, observing animal growth or testing soil. Tasks to be performed include reading, writing, demonstrating, viewing films, listening to tapes, records, debates and panels, drawing and constructing using paint, clay, wood, and plaster of paris. Teaching aids would include globes, charts, models, and exhibits.

Language Arts: The language arts include developmental reading, literature, listening, speaking, grammar and usage, writing, spelling, and handwriting, and are based upon the premise that language is learned through use. Learning activities may include a variety of areas such as reading in readers, factual materials, or library materials; writing letters, reports; or creatively engaging in dramatics and kin-aesthetic activities; listening to lectures and viewing demonstrations; drawing and construction; and playing word games.

Social Studies: Social studies is an integration of economics, sociology, political science and anthropology with history. Subject units in the fifth grade include units of Discovery and Exploration, Colonization, Westward Expansion, and Regional Studies of the United States. The teaching method is generally based upon the discussion technique with props such as charts, chalkboards, filmstrips, maps, etc. Students are required to make some preparation, either by reading the text or some other reference material. Activities might include reading poems, fiction, history, biography, newspapers or magazines; studying maps, globes, charts or two and three dimensional exhibits; constructing dioramas, relief maps, models, charts, maps, murals or diagrams; interacting with discussions, reports, clubs, games or songs; dramatizing, and planning for a course of study.

Music and Art: Music and art can be taught in separate classrooms, but provisions should be made within the classroom for rhythmic activities, singing, listening to records, wet and dry construction, painting, and drawing and pasting.

Physical Education: Physical education takes place in a separate unit and recess is out of doors, but during inclement weather the room may be cleared somewhat for games. Equipment which helps in the development of the student's co-ordination and motor skills should be available throughout the school day.

FLES*: Foreign languages are generally taught for about 15 minutes a day and involve a total group presentation with group or individual responses. If audio-visual materials are used, they should be so situated that the teacher is free to move among the students to hear the individual response.

EDUCATIONAL SPECIFICATIONS

The curriculum and related activities correlated with the student's physical and social characteristics begin to determine the educational facilities required for the fifth grade. These relationships are expressed as the educational specifications for the environment. A condensed set of typical specifications is described as follows:

Full Group Activities: Full group activities require the capability to seat all students with an orientation toward a given presentation point. The presentation might take the form of information written on the chalkboard, exhibits on tackboard or table, charts, maps, or audiovisual presentation, lecture, demonstration, discussion panel, or recitation. Traffic space should allow students to move from their seats to the presentation area to write on the chalkboard, point to a map or chart, etc. Demonstration facilities should include access to the sink area.

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*Foreign Language in the Elementary Schools

Work Groups: Students divide themselves into work groups for most of the day. Work would include use of audiovisual aids, books, dry construction. Playing games and practicing skits might occur in these groupings. Size of groups would vary from 2 to 8. A discussion group area for up to 12 students should also be provided, allowing for visual and auditory interaction. Desk arrangement should provide for student and teacher movement between areas.

Total Room Activities: Occasionally an exhibit, student fair, play store, or some other activity requires the use of a very large space within the classroom. Traffic would be heavy and erratic, and might involve more students than are generally serviced by the room.

Reference - Conference: An isolated area where 1 to 7 pupils may carry on individual or small group research using reference or audio-visual materials should be provided. Tables and shelving are needed for work surfaces and storage. Conference space for student teacher discussions is required. This space might also serve as an office area for the teacher with a desk and file cabinet and facilities for lesson planning and preparation.

Individual Study: An activity which frequently occurs is that of an individual completing an assignment. Room arrangement should encourage this activity while providing for other activities at the same time. The teacher should also be provided with space in which to make preparation, complete administrative tasks and confer privately with students, parents and other faculty.

Wet Activity: A room area should be provided for art, construction, or science activities. The space must be arranged so that 2 to 8 students may cooperate in a construction activity or science experiment. The student must be able to engage in large muscle movement within the area. Note that major art activities might also occur in a separate specialized room.

Interclass Activities: Areas should be provided for lecture-demonstration for up to 50 children. There may also be provision for interclass study, small group discussion, or work group activities. Presentations to larger groups should be made in an auditorium.

Out of Class Activities: Provision should be made outside of the classroom for: (a) physical education, (b) instrumental music, (c) home economics, (d) woodshops, (e) theater-assembly, (f) toilets, fountains, (g) health rooms, (h) telephone communications, and (i) food service, etc.

Storage: Storage units and space are needed for the following: (a) maps (physical and political), charts, globes, (b) large and small projection screens and audio-visual equipment, (c) animals, plants, and science demonstration, (d) supplies for art materials, stationery, games, and outdoor equipment, (e) books, magazines, and other reference materials, (f) student outer wraps and personal belongings, (h) basic first aid supplies, (i) display materials, panels, tackboards, pegboards, flannel boards, display cases, and tables.

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DESIGN DEVELOPMENT

INTRODUCTION

Given the educational development, as described in the preceeding section, the problem for the design team was to develop design criteria, which would satisfy the educational needs for the environment. This development was therefore based on determining the implications for design in the educational background information and relating this to specific design decisions in the formation of a typical solution. The following is a brief summary of implications and solutions as they affect the nature of the teaching space, classroom, areas within the classroom and utilities.

NATURE OF THE TEACHING SPACE

As the information on the educational background was being gathered, basic decisions were being made concerning the nature of the teaching space to be developed:

Generalization: Since the typical solution would not be intended for any particular site and since the project would not be considering in depth any other areas of the school, the teaching space must of necessity be developed in a generalized context, based on external constraints, with the assumption that the solution might be specifically adapted for use in a given situation. Problems of orientation, relation to other areas of the building, and construction are only generally indicated.

Flexibility: During the information gathering process, it became apparent to the team that one of the major areas of inadequacy in present school design was the lack of flexibility because space was rigidly defined by fixed walls and room arrangements. It is assumed that as teaching methods evolve and educational systems expand many changes in both function and purpose should be anticipated and room and space rearrangements should be accomplished with minimum expense. Similarly room layout and subdivisions should be kept flexible to allow a variety of teaching activities and differences in teaching methods.

Interroom Connectivity: One particular constraint was the desirability of interrelating different classrooms comprising the fifth grade so that they would be physically adjacent and in some cases directly connecting with movable walls or partitions. This would not only permit greater ease in communication between classrooms but would permit joint class activities and higher level of flexibility in utilizing the teaching space.

NATURE OF THE CLASSROOM

As the curriculum and educational specifications were developed, the nature and form of the classroom became more clearly defined. These resulted in criteria related to the nature of the classroom which would ultimately be designed:

Classroom Areas: While there were a variety of activities occurring in the classroom, many of these activities used common facilities or had common space requirements. As these activities were grouped they implied the designation of six functional areas within the classroom:

a. Presentation - a large central area with space for seating twenty-five students; used for lectures, group and seat work, and large demonstrations.

b. Independent Study - a library-reference for individual and group study, visually and acoustically isolated from the presentation area, with facilities for use of audio-visual aids.

c. Construction-Science - a separate area with workspace and facilities for wet and dry contruction and science experiments.

d. Display - an area for exhibits and displays, large models, and dramatic presentations, with free-floor space and vertical display surfaces.

e. Teacher Office - a semi-isolated space for clerical activities, lesson planning, and student-teacher conferences.

f. Wrap Storage - an area isolated from the rest of the room where students could put on and take off their outer wraps and where soil and moisture could be contained.

Room Flexibility: While these separate areas may be identified, it is apparent from the variety of activities anticipated that these areas should not be inflexibility bound, thus allowing different rearrangements within the general area structure. This would probably require the use of moveable partitions and equipment units. The design solution must therefore consist of a balance between the provision and definition of areas and the capability to maintain a variety of flexible room arrangements.

Area Flexibility: The activities specified in the curriculum require that a variety of activities should be accommodated within each area. Consequently the space and facilities provided for each area should be capable of multiple use and function, and the general capacity for flexibility should be maintained. This should result in both a mobility of equipment and furniture and the generalizability of function to allow a variety of groupings and recombinations. Specific emphasis should be given to the possibility of a variety of configurations of student work groups within each area.

AREA REQUIREMENTS

By refining the information available in the educational development and supplementing this with specific reference sources, it was possible to begin defining the design criteria or requirements for different areas within the classroom in terms of spatial relationships between these areas and the functional (equipment) needs for activities in each. These criteria began to define the arrangement of areas within the classroom and to identify furniture and equipment needed for the solution.

Presentation: As the central work and presentation area this space should be readily accessible from all other areas and should communicate directly with the room exits. Provision should be made for joining the presentation areas of two adjacent classrooms for joint use. This room should be equipped for a variety of audio-visual presentations including film, television, tape, slide, records as well as displays of charts, maps, and diagrams. Models and exhibits should be readily available as well as facilities for scientific and other demonstrations.

Independent Study: This area should be adjacent to the general work area and removed from areas containing distractions, such as the construction areas and out-of-doors. This area should also communicate with the Teacher Office for individual assistance and consultation. The area should be provided with work space, books, magazines and other reference materials as well as audio-visual and other teaching aids for individual and small group use.

Construction-Science: This area should be adjacent to the presentation area with which it shares sink and demonstration facilities. It should also communicate with the main outdoor exit and the display area. This area and the independent study area may be connected to the adjacent classroom by a movable wall to facilitate interclass projects. Facilities should include sink, impervious work surfaces and flooring, storage for materials and plant and animal exhibits and space for large models and construction.

Display: Since teaching activities may include use of the display area as a supplement to other major presentations the display area should be adjacent to the presentation area, perhaps as an extension at the rear of this area. Relationships are also possible with the reference or independent study area and the room exits. The most important criteria is the provision of space to set up exhibits and tables, with an ample supply of vertical display surfaces. Storage facilities should be provided for a supply of different display panel types, easels and other display aids.

Teacher Office: The teacher's office should be removed from the general work activity and room traffic areas but should have a clear view of the room for supervisory purposes. Location adjacent to the independent study area provides both isolation and availability to students and reference materials. Facilities should include work surface and seating for teacher and conferees, storage for clerical supplies, file records, personal belongings, and provision for audio-visual previewing.

Wrap Storage: This area serves as an entrance or mudroom, a vestibule between the classroom and the out-of-doors. Provision should be made for heating and ventilation as well as hangers and storage for personal belongings.

CLASSROOM ENVIRONMENT

While a general set of criteria may determine the form of the classroom related to curricular activities, details of the final design must take into account other factors in the environment which may affect human performance: Lighting, acoustics, and heating. These factors which affect the structural and building specifications as well as room equipment are briefly summarized here.

Lighting: Light quantity is related to specific tasks, but generally should provide the amount needed for acuity without creating problems of visual stress from too high a level. Light level should be controlled for audio-visual aids, preferably with zone or area control. The light should be evenly distributed in such a way that glare and excessive brightness are minimized. Some modeling in the room should be provided. In addition some daylight should be used in room lighting to provide for a satisfactory spectral quality. While the point is debatable, some visual access to the out-of-doors should be provided.

Acoustics: Noise or intrusive sound should be controlled, although intensity is not as serious when the sound is general and unidentifiable. Masking sound may be an important aid in auditory adaptation and as a cover for low intensity distracting sounds. This should be general sound, perhaps built into the ventilating system. Reverberation or excessive noise bounce should be controlled, possibly by using carpeting. It is important to consider not only the intensity but also the frequency of reverberation.

Temperature: Temperature should be controlled both by heating and cooling with slightly lower temperatures recommended while heating. A double-duct system with simultaneous heating and cooling is needed to provide proper control. Air movement should be controlled to prevent stagnation without excessive disturbance and should include an addition of some fresh air. The proper level of humidity should be maintained, generally with mechanical assistance. Similarly air ionization should be negative within the comfort range.

DESIGN SYNTHESIS

While the criteria as developed above indicate in a general way factors to be considered in the design of a fifth grade classroom, many of the interrelationships among criteria become clear only in their integration into a design solution. In the early educational development, the bulk of the responsibility rested upon the educational specialist member of the team who presented information and was interrogated by the designers. Correspondingly, in the design development there was considerable interaction between design and educational specialists and between the resulting educational and design specifications. In the final phase, the responsibility for synthesis rested basically with the designers, assisted by the educational specialist. Thus the formation of the solution is not only a synthesis of criteria but also a synthesis of team effort.

In the development of the solution, the factors of generalization and flexibility set the tone for the specification of teaching space, while the need for space and interroom relationships determined the general configuration and orientation of the classrooms. Within each classroom the space and arrangement were guided by the teaching areas and their relationships. As the areas were developed, the support facilities of furniture and equipment were identified and finally designed to accommodate the area functions. Additional details were based on the requirements for the educational environment and other physiological considerations.

The solution is presented in the following series of annotated drawings, covering the structural and spatial characteristics of the teaching space and individual classrooms and the specific designs for specialized items of furniture or equipment. Together these present the synthesis of implications developed from the educational background information on the design of the fifth grade classroom. While the solution is designed as an integrated one, it is assumed that some modifications would be made in adapting to specific curricula, teaching methods or geographical areas.

ARCHITECTURAL DESIGN

INTRODUCTION

The design of an environmental system is an iterative process exemplified by a series of loops going from the most general space down through the most specialized equipment and then back again. In other words in the development of an integrated classroom it is necessary to define the general teaching space before designing the individual classroom, but at the same time it is important to have a conception of the individual classroom before designing the general space. In a similar way, in order to design furniture and equipment for use in the classroom it is necessary to know the layout and structure of the classroom, but this design of a classroom is in turn dependent upon anticipating the equipment which will be used within it. Such a process was used in the synthesis of the design solution, however this is difficult to portray in a verbal format without excessive redundancy, so the solution is here presented in a linear manner from the general to the specific, with the iterative loops which ocurred in the design decision-making assumed or understood.

The discussion and illustrative material in this section of the design synthesis will present the overview of the total solution, with the following section devoted to details of equipment and furniture. The design of the classroom is included along with the area and structural drawings included to show generally how this might be accomplished. As has been mentioned, the decisions in the solution are based on the educational and design development and the major criteria and interpretations will be included to show how the solution was derived.

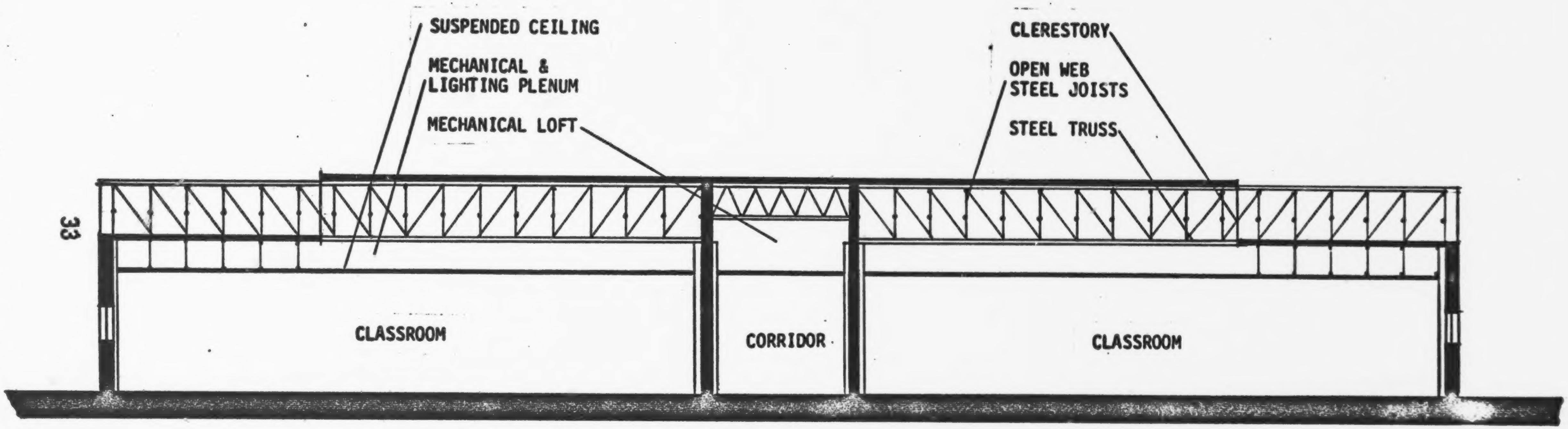
The basic format for designing the teaching space was the establishment of two fifth grade classrooms of twenty-five students each. Although various configurations are possible in the spatial arangements within each room, economy and convenience suggest that the general shape of the individual classroom should be rectangular. Similarly interroom connectivity implies a linear grouping of classrooms for maximum access, resulting in a large rectangular teaching area. The use of windows and ease of exterior access require that all classrooms have one exterior wall, and common practice suggests that the corresponding wall should form one side of either a single or double-loaded corridor. The wrap storage-vestibule area should be structurally isolated for safety and thermal control and may extend into the classroom to reduce the space required. Clerestory windows which are required will be discussed in a later annotation.

The teaching space which was defined is a 40 by 60 foot area, including two 30 foot individual classrooms of 1200 square feet. In this solution the teaching area is structurally defined as an integral unit with no interior supports. This allows for a continuous ceiling and flooring system, and includes the necessary flexibility to provide for conversion and restructuring as required by changing conditions. It is assumed that this may be part of a larger building system using a shell or hanger structural method, or may be adapted to other specialized uses. The wrap storage area is shown projecting into the space, with two adjacent classrooms sharing the facilities.

1. GENERAL TEACHING SPACE-BUILDING SECTION

This detail further defined the general teaching space based on additional criteria. An important aspect is the problem of admitting sufficient daylight to balance the spectral quality of the room lighting without creating a large area of excessive glare. This may be accomplished by the use of clerestory windows, opening above a suspended diffusing ceiling, which transmit both natural and artifical light. A more limited and easily controlled vision strip can then be provided within the classroom. In maintaining flexibility within the building, mechanical services should be easily installed, serviced and relocated as needed.

This section shows one structural approach for a typical building situation. Trusses are provided across the width of the building, supported at both the exterior and corridor walls. The space above the corridor formed by the truss sections may be used as a mechanical loft space permitting convenient access. Services can then be extended laterally into the rooms utilizing either the planum above the suspended ceiling or a Q-Type floor with conduits. This structural system accomodates the clerestory opening by alternately suspending the secondary roof supports from the top and bottom chords of the main truss.


SUSPENDED CEILING
MECHANICAL & LIGHTING PLENUM
MECHANICAL LOFT
CLERESTORY
OPEN WEB STEEL JOISTS
STEEL TRUSS
CLASSROOM
CORRIDOR
CLASSROOM

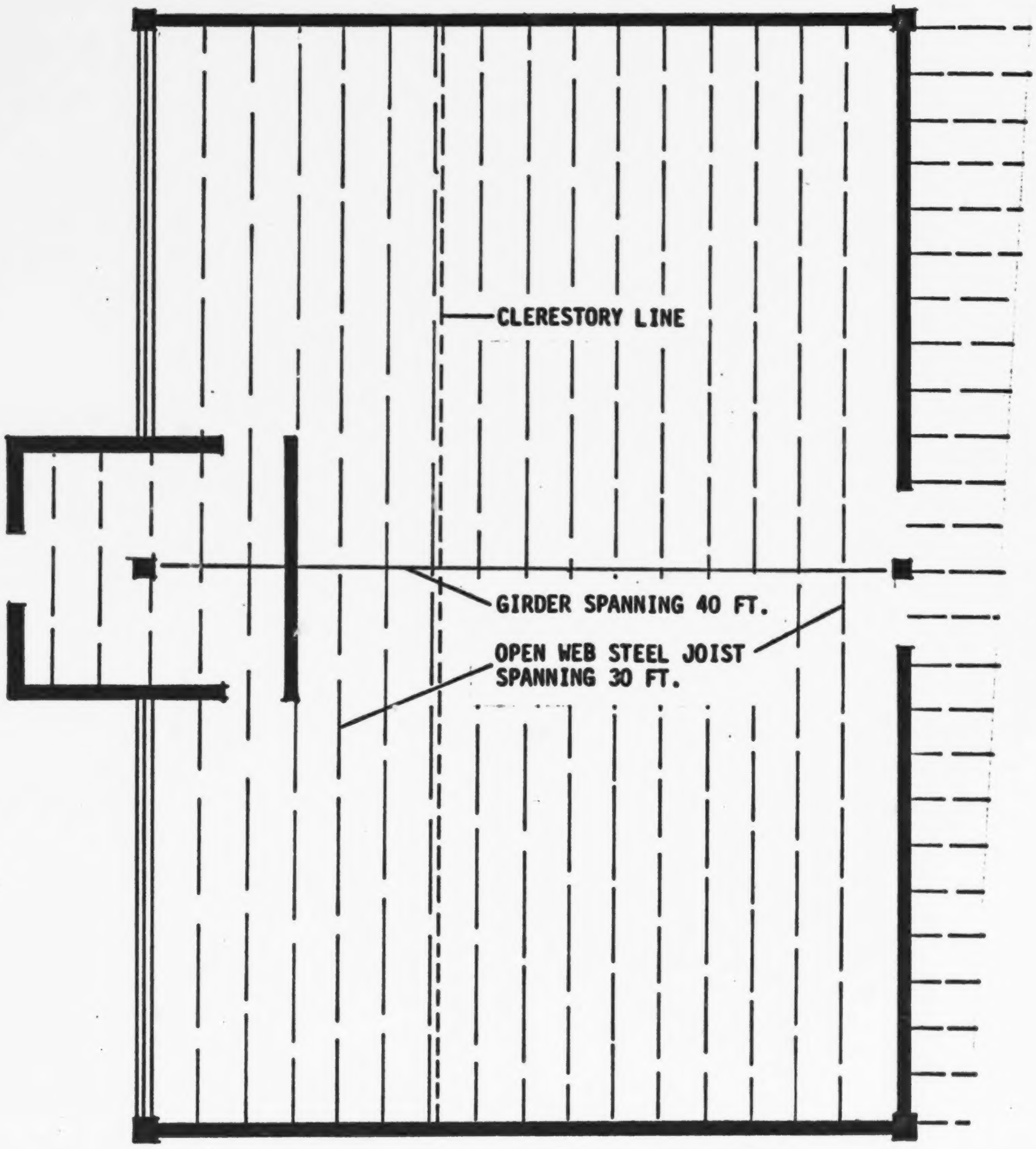
TRANSVERSE STRUCTURAL SECTION OF DOUBLE-LOADED CLASSROOM WING

1

2. GENERAL TEACHING SPACE - STRUCTURAL DETAIL

In order to further explore the structural and design implications of this solution, a detail of the structural framing system is included. As indicated, the major trusses are located at 30 foot intervals corresponding to the classroom bays, with secondary beams spanning perpendicular to the primary trusses. These secondary members may be either steel beams or open web-steel joists. While this is included as a typical example it should be emphasized that final choice of structural material systems depends upon the design of the rest of the building, specific factors in local ordinances, material availability, and local environmental conditions.

2


CLERESTORY LINE
GIRDER SPANNING 40 FT.
OPEN WEB STEEL JOIST SPANNING 30 FT.

STRUCTURAL FRAMING SYSTEM

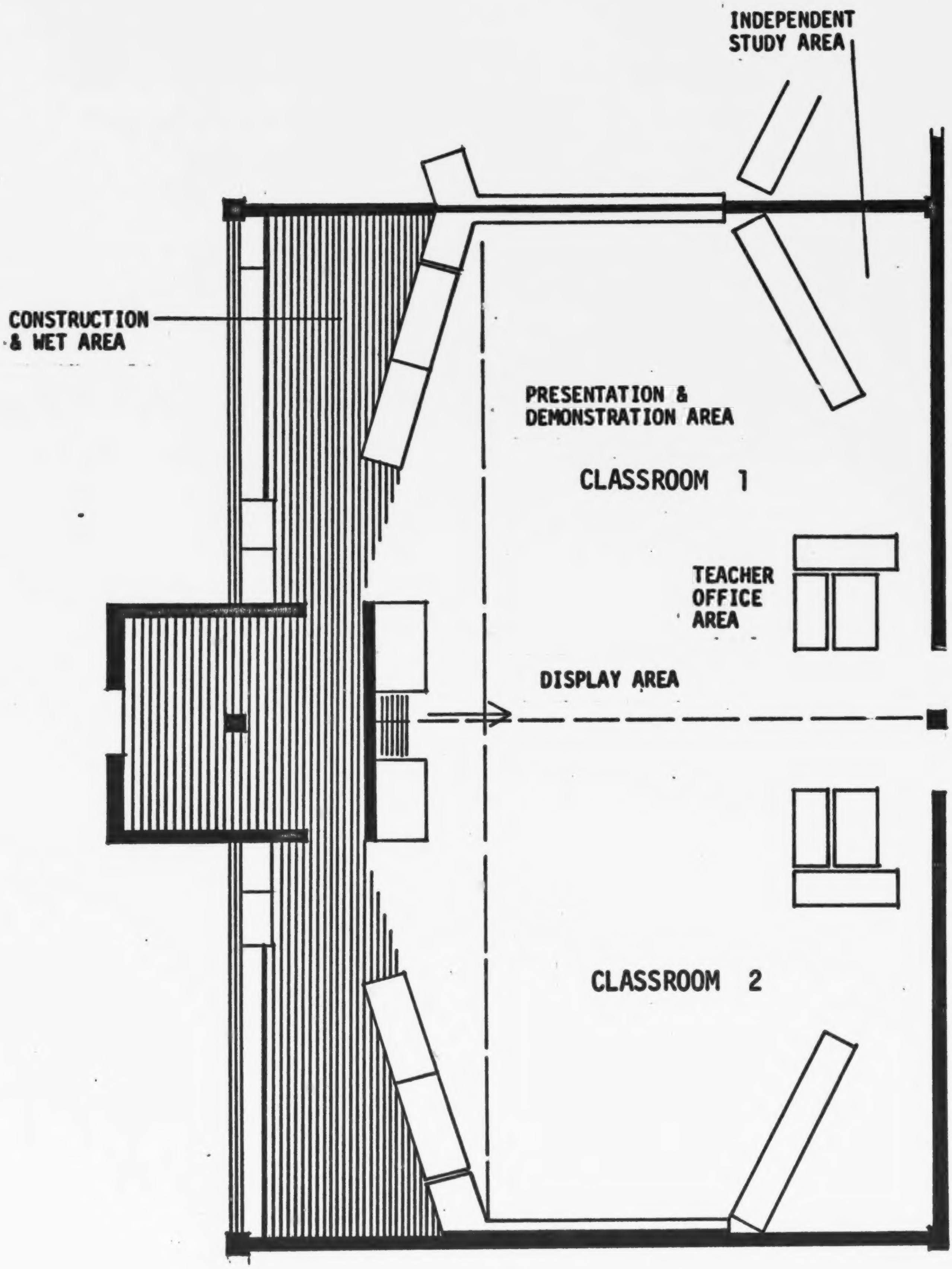
2480 SQ. FT.

3. CLASSROOM LAYOUTS

This layout shows schematically the basic solution for the fifth grade classroom. This is the total synthesis of all the educational background and design development investigations. Basic factors which may be identified include the division of the general space into three similar classrooms; the interconnectivity of the classrooms, with provision for alternative connections for flexible use; the provision of both fixed and temporary partitions within the classrooms; and the use of carpeted and tiled floor coverings for different functional areas.

The two classrooms as shown are mirror images of each other in the basic format. This allows the rooms to be opened along the long wall for a joint presentation area when necessary. In this diagram, the fixed walls are shown in solid lines and the movable partition shown as a dashed line between classroom 1 and 2. All other units are movable but they are shown in the anticipated standard position to define the construction, independent study and teacher office areas, which will be described in greater detail later. The flooring material, which is indicated by the shading, provides for carpeting in the presentation, display, and independent study areas to provide comfort and acoustics, while the construction areas has a tile floor to resist increased wear.

3


INDEPENDENT STUDY AREA
CONSTRUCTION & WET AREA
PRESENTATION & DEMONSTRATION AREA
CLASSROOM 1
TEACHER OFFICE AREA
DISPLAY AREA
CLASSROOM 2

TWO CLASSROOMS

EQUIPMENT, FLOOR FINISH &
MOVABLE PARTITION PLACEMENT

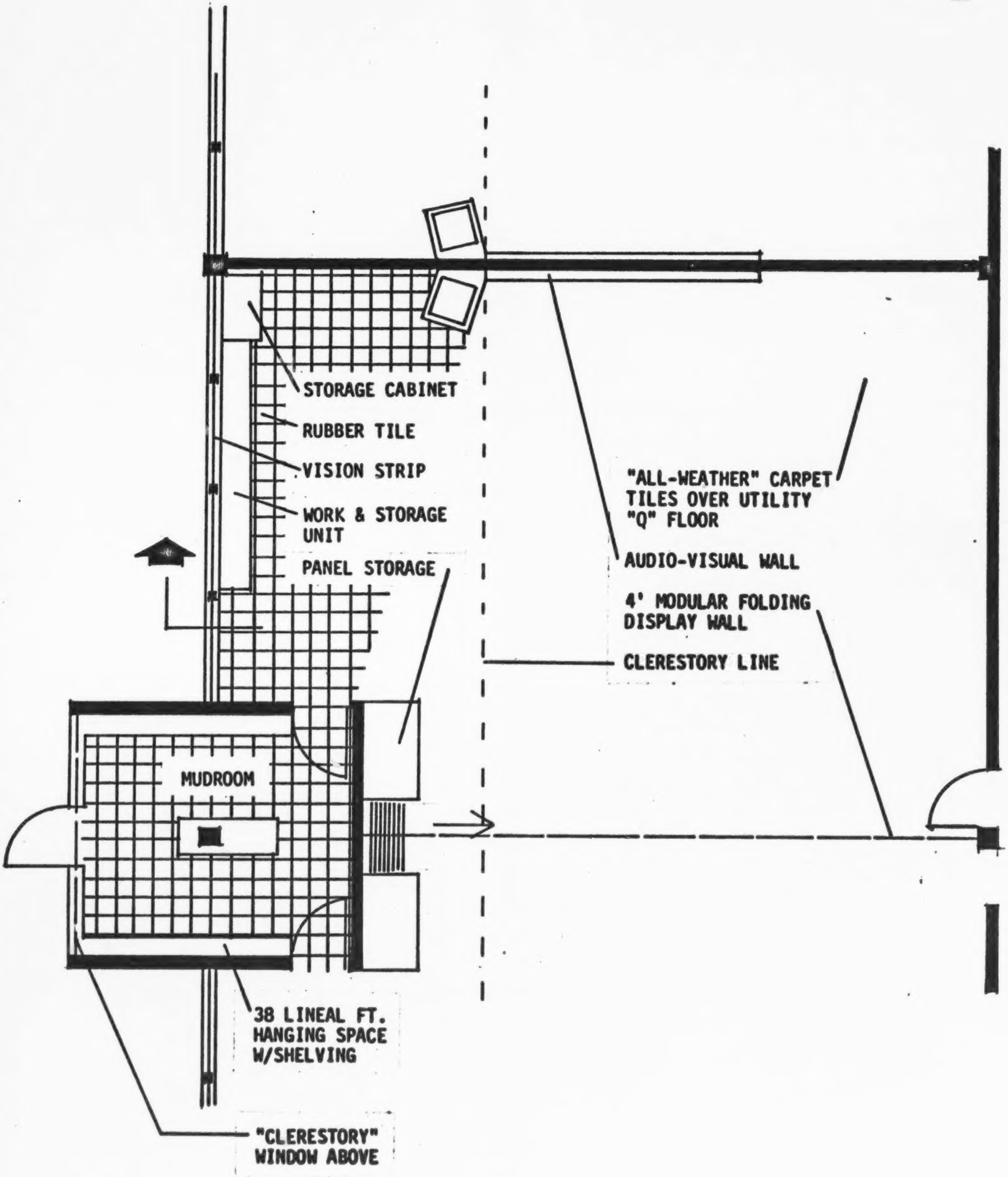
2480 SQ. FT.

4. CLASSROOM DETAIL - FIXED SPACE

Although it has been established that it is desirable to provide appropriate facilities for different learning areas within the classroom, these areas should not be so rigidly defined that they limit creative use of the room or predetermine teaching methods. The solution to this is the predominant use of mobile units which can be grouped throughout the room area. While the previous drawing included both fixed and movable units for illustrative purposes, this detail includes only those permanent or semi-permanent units which remain as a fixed part of room arrangements. Additional factors included in this layout are the provisions for individual wrap storage and the flexible use of floor coverings and electrical and other services.

The classroom shows the fixed units and the sink and audio-visual wall, storage units for display panels and art materials, and work counter-locker unit along the exterior wall. The wrap storage or mudroom shows a continuation of the tile floor and provision for shelves and hanging space. The only limitation to arrangement in the center of the classroom is the implied division determined by the change from carpet to tile flooring. While this is acceptable and intentional to maintain the integrity of the construction area, this need not be a hard barrier. The extension of carpeting over the remainder of the room allows for the relocation of mobile units to alter or extend the perimeter of the presentation area when needed. The use of rubber and carpet tiles allows for replacement due to wear or damage and facilitates the location and relocation of service outlets brought up from the Q-Type utility floor.

4


STORAGE CABINET
RUBBER TILE
VISION STRIP
WORK & STORAGE UNIT
PANEL STORAGE
"ALL-WEATHER" CARPET TILES OVER UTILITY "Q" FLOOR
AUDIO-VISUAL WALL
4' MODULAR FOLDING DISPLAY WALL
CLERESTORY LINE
MUDROOM
38 LINEAL FT. HANGING SPACE W/SHELVING
"CLERESTORY" WINDOW ABOVE

CLASSROOM 1

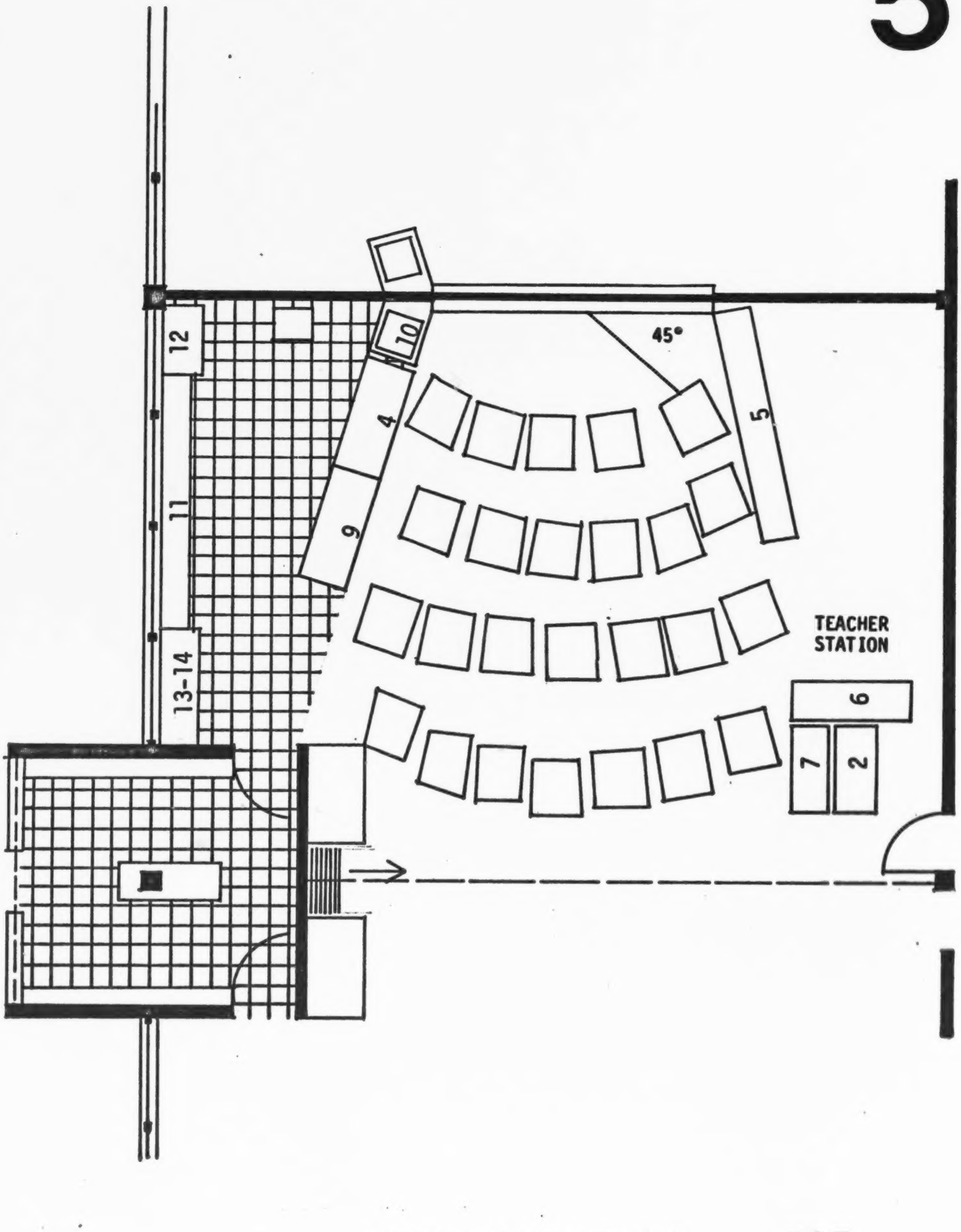
BUILT-IN EQUIPMENT

5. CLASSROOM DETAIL - MOVABLE UNITS

In contrast to the free space permitted by the placement of fixed units, the movable units are provided to articulate the room area. The advantages of the various types of equipment and the grouping and arrangement possibilities are discussed in detail in the equipment design section. The configuration which is shown here is suggested as the standard room arrangement; additional variations follow. The equipment number codes which are correlated with the detailed explanations in the following section are identified as follows:

1. Audio-Visual Unit
2. Teaching Station
3. Screen Unit
4. Demonstration Cart
5. Bookshelf
6. Map Cart
7. Audio-Visual Cart
8. Television Unit
9. Work Table
10. Sink Unit
11. Locker Unit
12. Art Storage
13. Zoological Unit
14. Botanical Unit
15. Display Wall
16. Panel Storage
17. Paint Cart
18. Student Desk
19. Student Chair

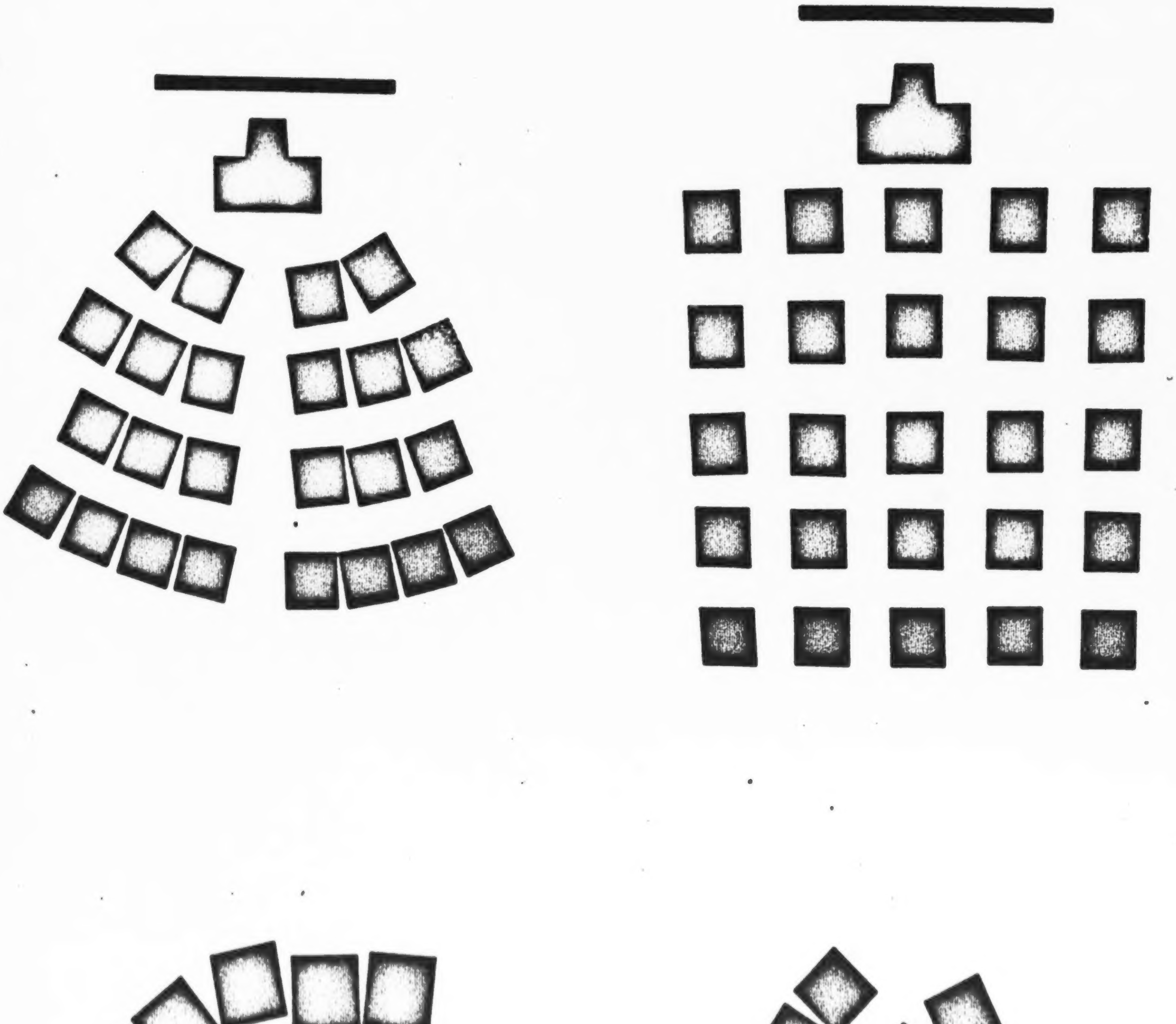
5



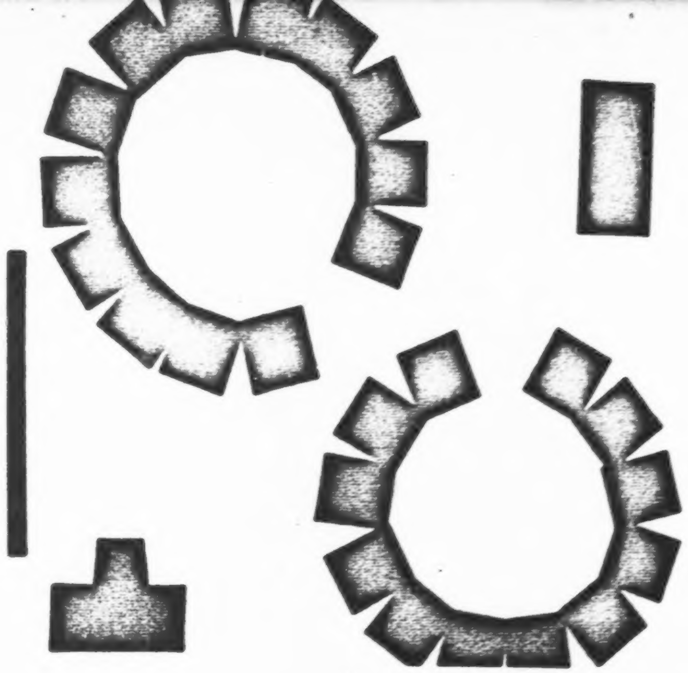
45°
12
10
4
5
11
9
TEACHER STATION
13-14
6
7
2

A CONFIGURATION FOR

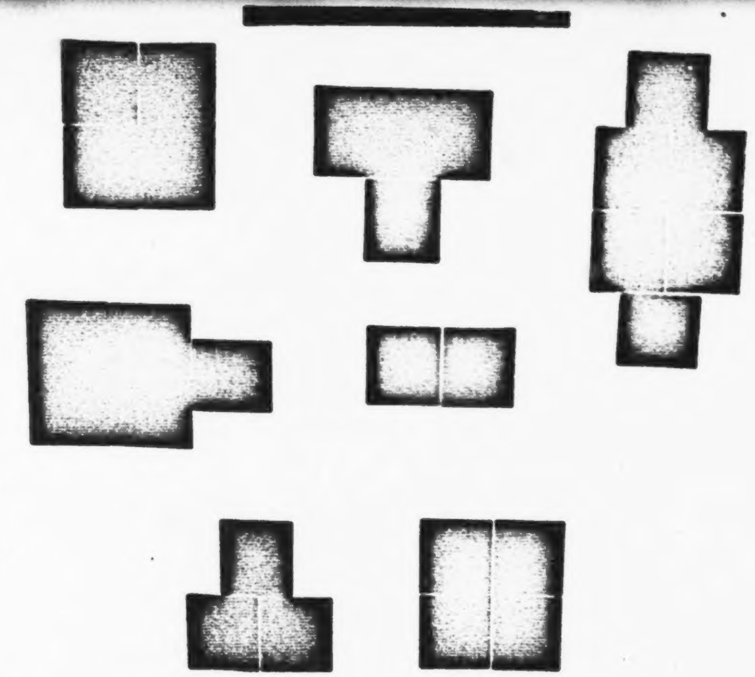
FULL GROUP PRESENTATION



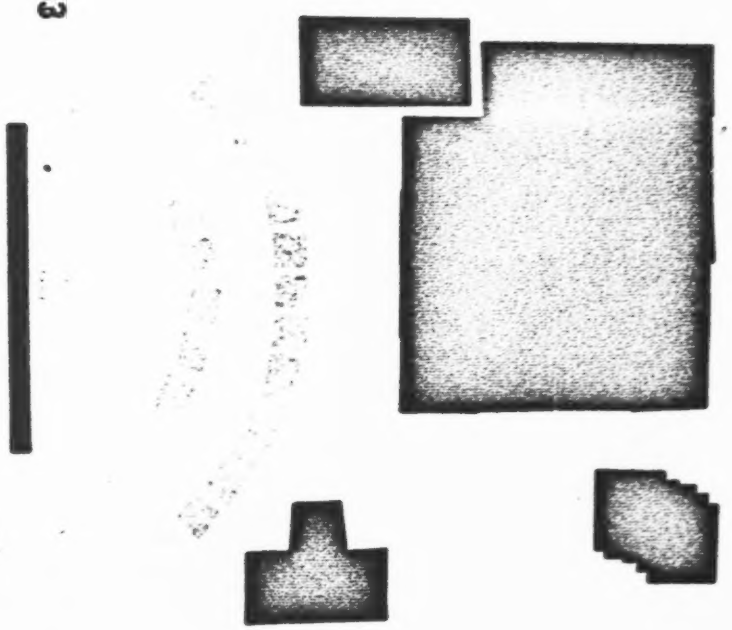
FULL GROUP PRESENTATION CONFIGURATIONS



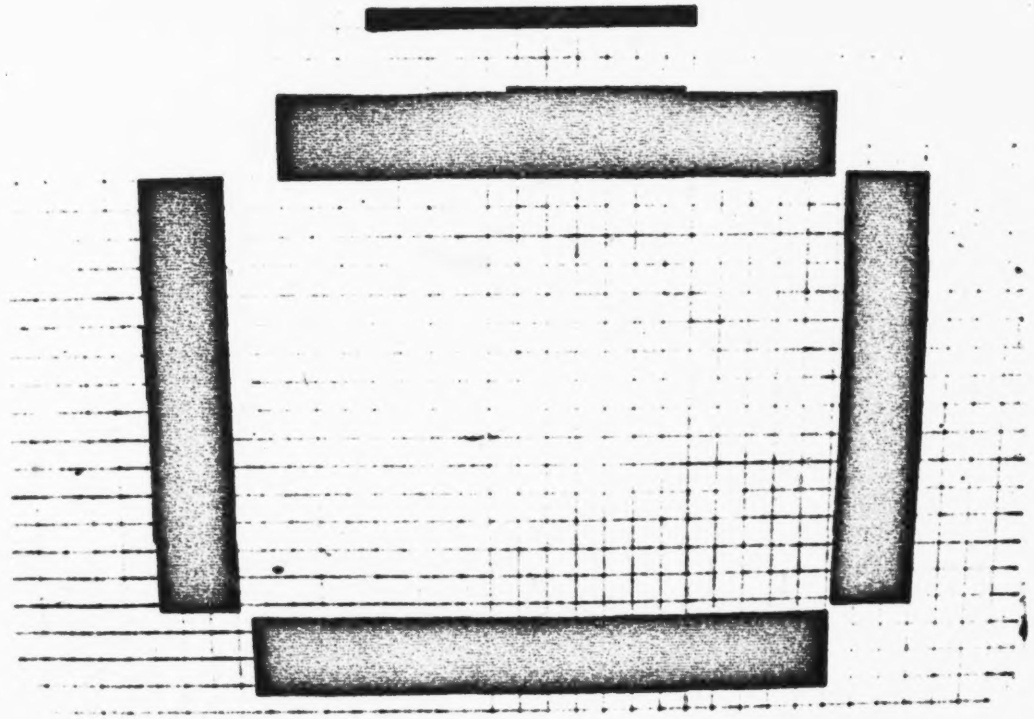
DOUBLE DISCUSSION GROUPS



MULTI-CLUSTER GROUPING



SEATED LECTURE GROUPING



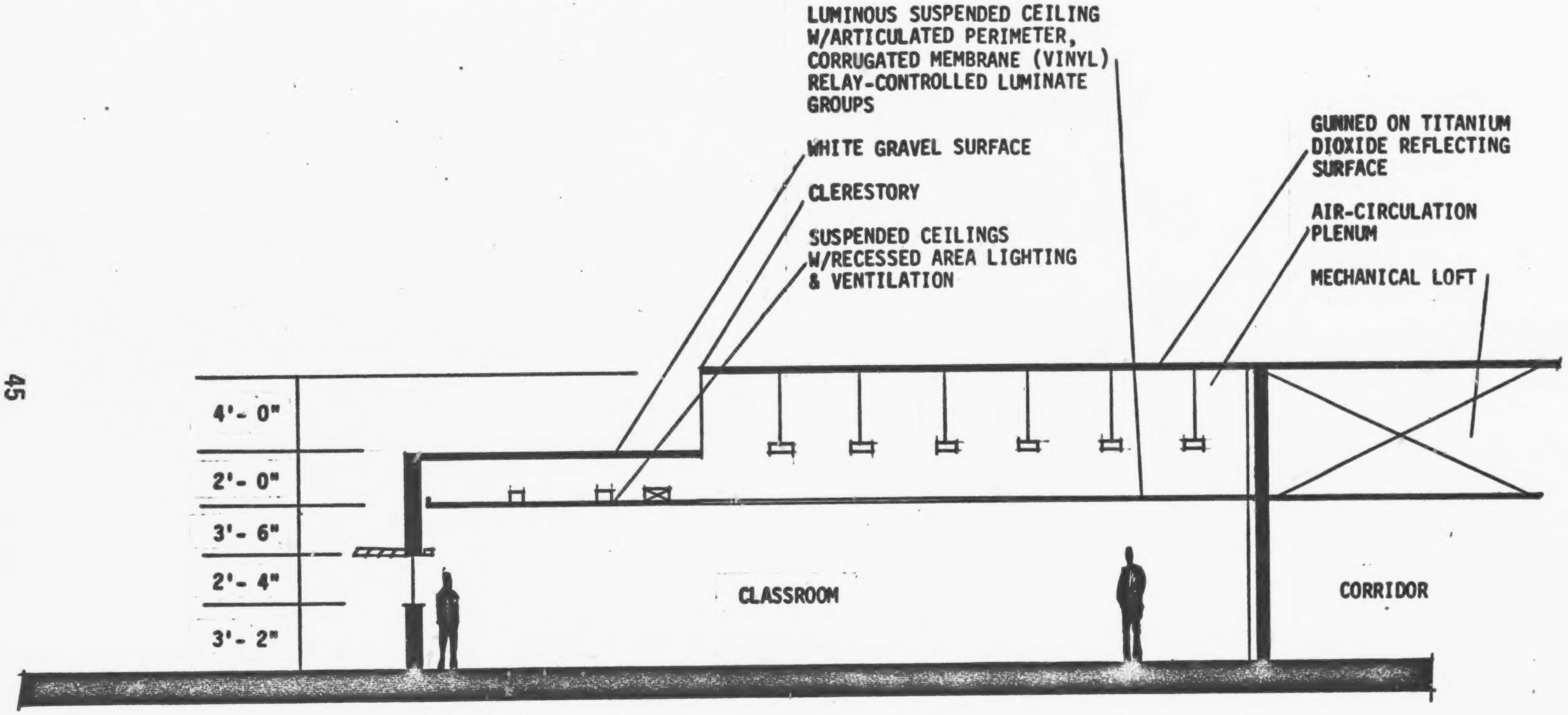
ENCLOSED FULL-GROUP DISCUSSION

MULTI-USE CONFIGURATIONS

6. ROOM DETAIL - BUILDING SECTION

Additional factors in the solution are illustrated in this section of the classroom. The suspended ceiling must permit proper diffusion of light while allowing ready accessability to lighting units. Lights, heating and ventilation equipment must be provided. Light must be controlled for quantity, glare and reflectance.

This section shows the room equipped with a luminous suspended ceiling utilizing an articulated perimeter and corregated vinyl membrane. Lighting above the ceiling is wired by area with relay-controlled switches to vary intensity. Heating and ventilation equipment are located in the space above the ceiling using the available air circulation plenum. The plenum is acoustically insulated from adjacent areas with a sound-absorbent blanket. The room ceiling above the plenum is treated with sound absorbent material and spray painted with titanium dioxide to provide a reflectant surface. The clerestory opening for daylight is controlled with photoelectric louvers, while the vision strip is regulated with venetian blinds and shielded from direct glare with a sun screen.


LUMINOUS SUSPENDED CEILING W/ARTICULATED PERIMETER, CORRUGATED MEMBRANE (VINYL) RELAY-CONTROLLED LUMINATE GROUPS
WHITE GRAVEL SURFACE
CLERESTORY
SUSPENDED CEILINGS W/RECESSED AREA LIGHTING & VENTILATION
GUNNED ON TITANIUM DIOXIDE REFLECTING SURFACE
AIR-CIRCULATION PLENUM
MECHANICAL LOFT
4'- 0"
2'- 0"
3'- 6"
2'- 4"
3'- 2"
CLASSROOM
CORRIDOR

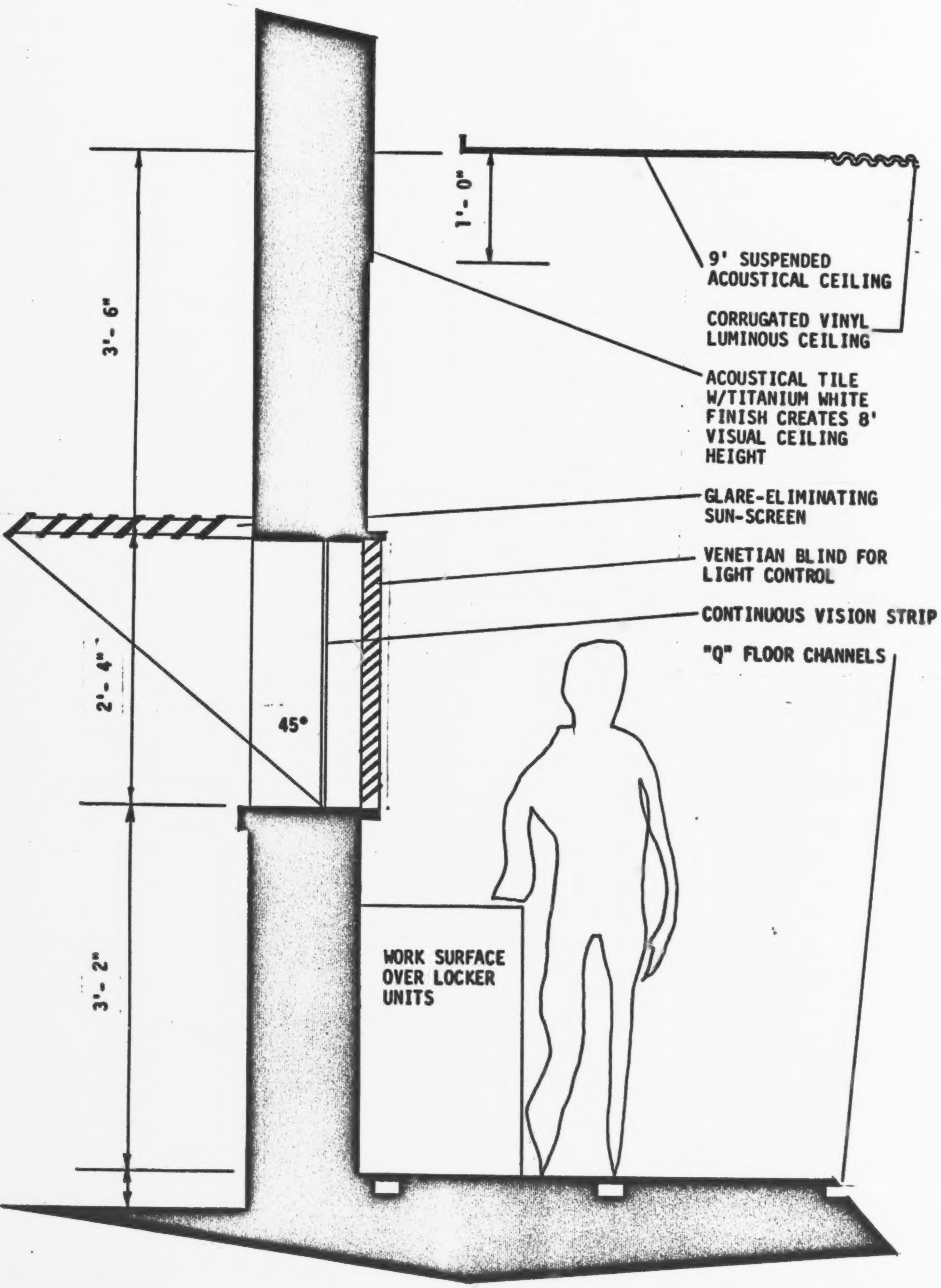
BUILDING SECTION

6

7. ROOM DETAIL - EXPLODED SECTION

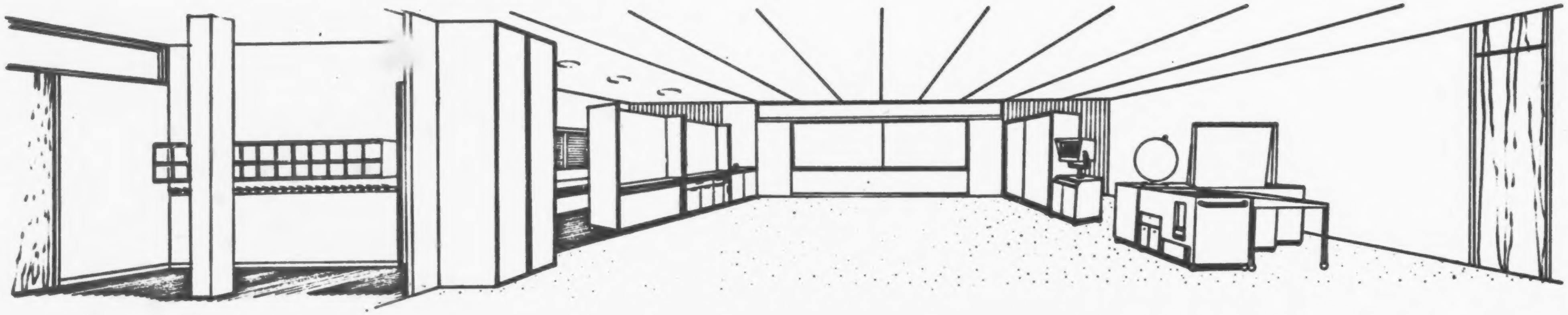
This section shows in greater detail the window and ceiling provisions, including the separation of the ceiling from the structural wall and the placement of acoustical material on the upper wall adjacent to the ceiling. The sun-screen and venetian blind units are shown in greater detail. Also evident is the location of the vision strip above the work surface and placed at the student's viewing height, but narrow enough to reduce discomfort elsewhere in the room.

EXTERIOR WALL SECTION 7


1'- 0"
3'- 6"
2'- 4"
3'- 2"
45°
9' SUSPENDED ACOUSTICAL CEILING
CORRUGATED VINYL LUMINOUS CEILING
ACOUSTICAL TILE W/TITANIUM WHITE FINISH CREATES 8' VISUAL CEILING HEIGHT
GLARE-ELIMINATING SUN-SCREEN
VENETIAN BLIND FOR LIGHT CONTROL
CONTINUOUS VISION STRIP
"Q" FLOOR CHANNELS
WORK SURFACE OVER LOCKER UNITS

8. CLASSROOM DETAIL - PERSPECTIVE

This view from the display wall at the rear of the display area shows the audio-visual unit at the front of the presentation area. The walls of the wrap storage area are cut away to show the details of shelves and hooks. In the right foreground is the teacher office, delineated by the audio-visual and map carts, with the television unit and independent study area beyond. To the left are the work table and demonstration carts under the screen units, with the sink closest to the audio-visual unit. Behind the screens in the construction area, the vision strip may be seen. This should give a better idea of the room relationships with the cautionary note that while this may be the standard position, throughout the day the room may appear in many different forms. Note also that the desks and chairs, normally located in the presentation area, have been omitted.



PERSPECTIVE

EQUIPMENT DESIGN

INTRODUCTION

While the architectural design solutions contain the critical specifications for defining the classroom space, much of the spatial configuration within the room and the facilities to support various class activities depend upon the specification of equipment and furniture units which are derived from educational variables. Equipment and furniture design is especially critical since many interior partitions are replaced with mobile storage units which can be adapted and recombined for a wide range of activities. These designs are therefore very important to the design synthesis of the classroom environment.

It is important that these units are not designed in isolation either from the curriculum or from each other, but that they function as part of a total environmental system. As is indicated there is a great deal of interdependence between the units in the room. The illustrations of the equipment which are included in the following pages are accompanied by annotative material which describe the function of each unit in the classroom system. As a general rule, the first paragraph describes the educational and design criteria which have generated the particular design. The second paragraph covers in some detail the various aspects of the design relating to the established criteria. The third section indicates the relationship of the unit to the classroom layout and to other units in the room, noting some of the alternative functions. Additional illustrative drawings are included in some instances.

1. AUDIO-VISUAL UNIT

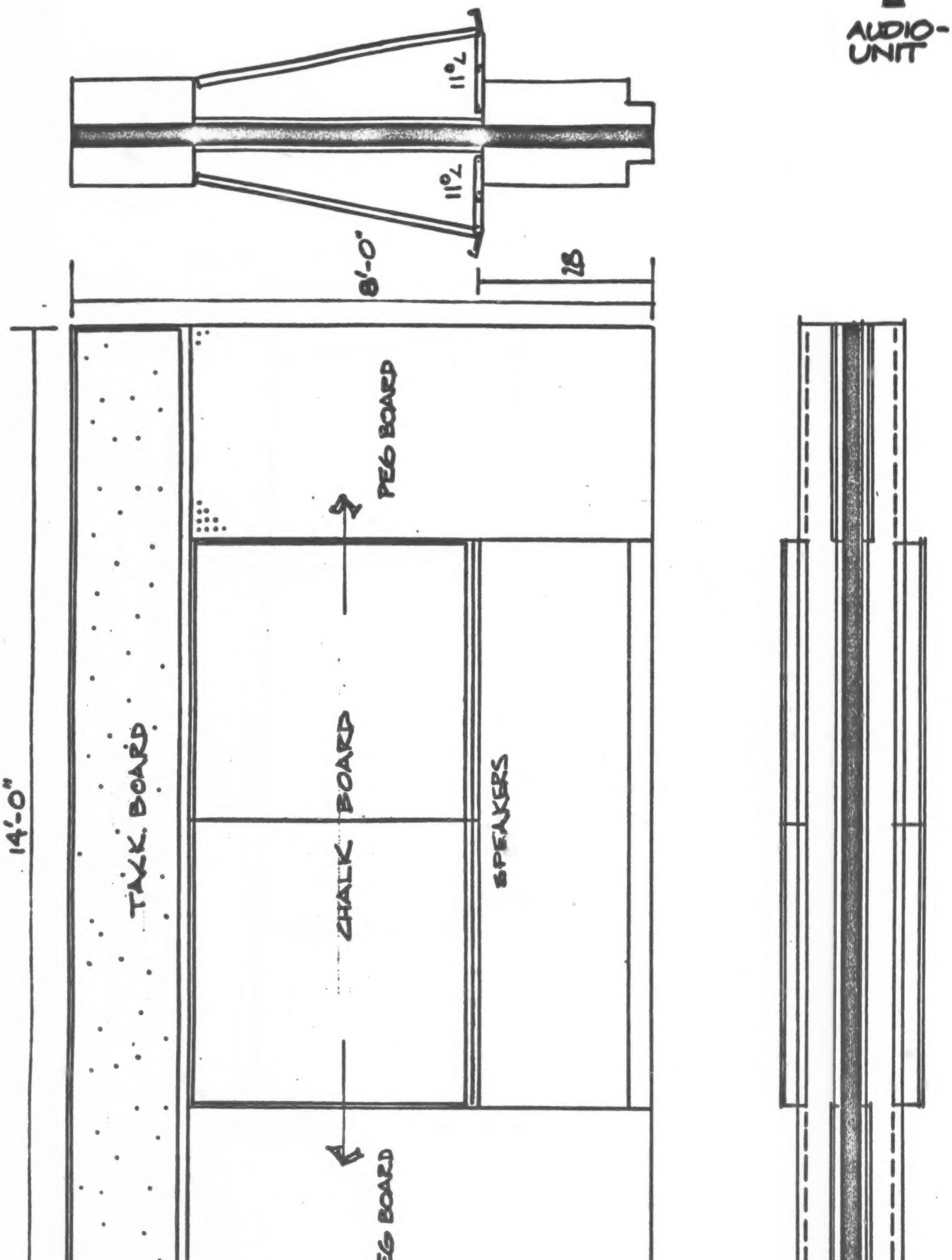
The major fixed partition in the classroom is the resource wall, which includes the sink and plumbing and the audio-visual unit. This unit serves as the focal point of the presentation area and contains the capacity and resources for a variety of teaching and learning activities.

This unit includes a green chalkboard in two sections, display boards, cork boards, map rail, projection screen and room speakers. The two sections of the chalkboard can be moved to each side to provide access to the projection screen. Additional sections may be added to provide additional chalkboard space. When in use, the chalkboard may be inclined outward from the bottom to provide a proper writing surface of 11 degrees. The map rail above the chalkboard may be used for displaying maps, charts or posters. A peg board material is used for the panels on each side of the chalkboard to accommodate hooks, racks and pegs for the display of art and craft work, models, exhibits, books, etc. Portable tackboards may also be placed here. Corkboard panels above the chalkboard may also be used for display. Speakers concealed behind a panel under the chalkboard may be used for audio-visual and other presentations.

This unit may be used in conjunction with the sink and demonstration table for scientific experiments or may function in normal use as the teaching station, with or without the overhead projector. The rear of the adjacent bookshelf contains additional tackboard surfaces which may be opened to provide access to a storage cabinet for teaching aids.

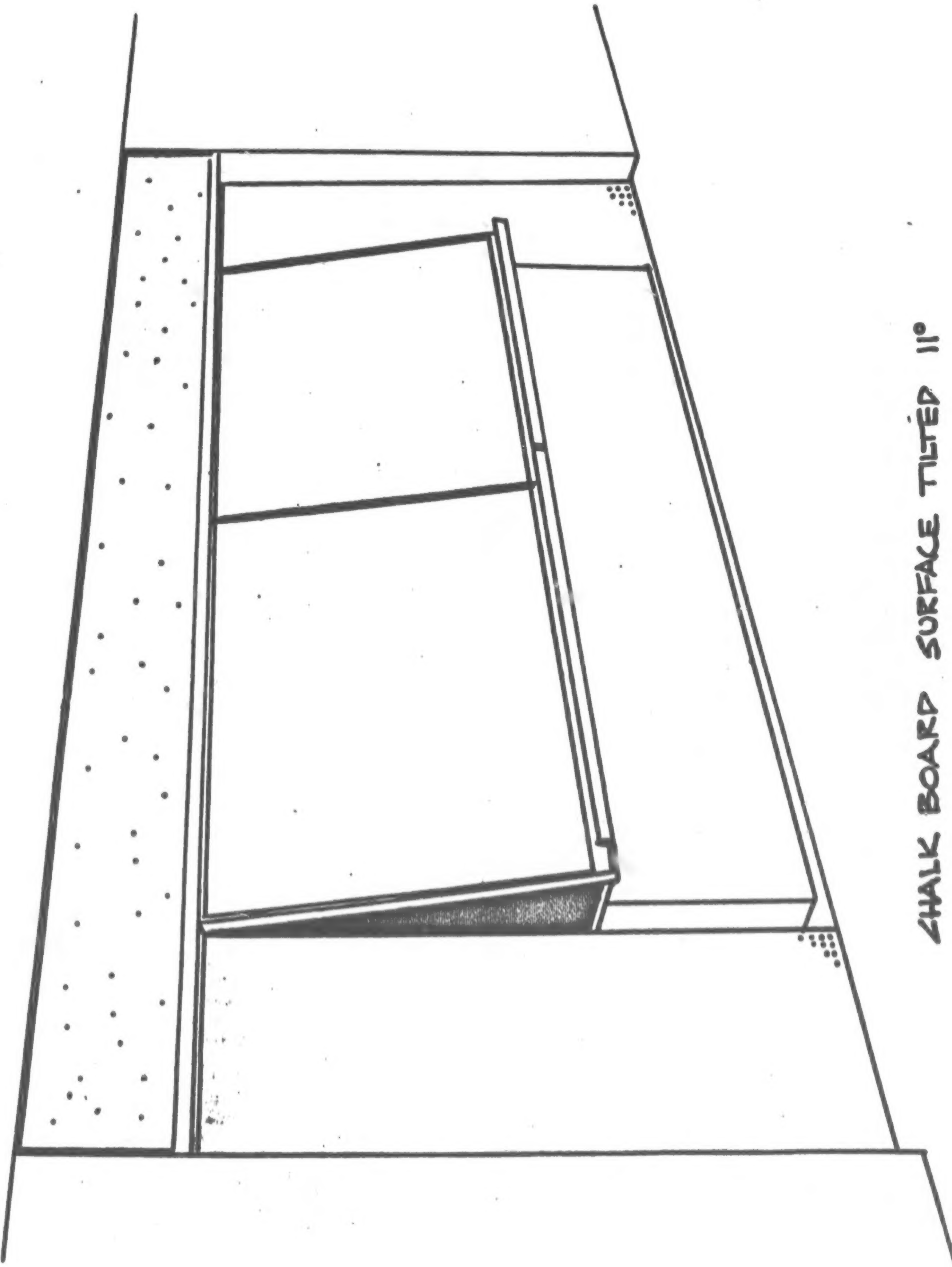
1

AUDIO-VISUAL UNIT

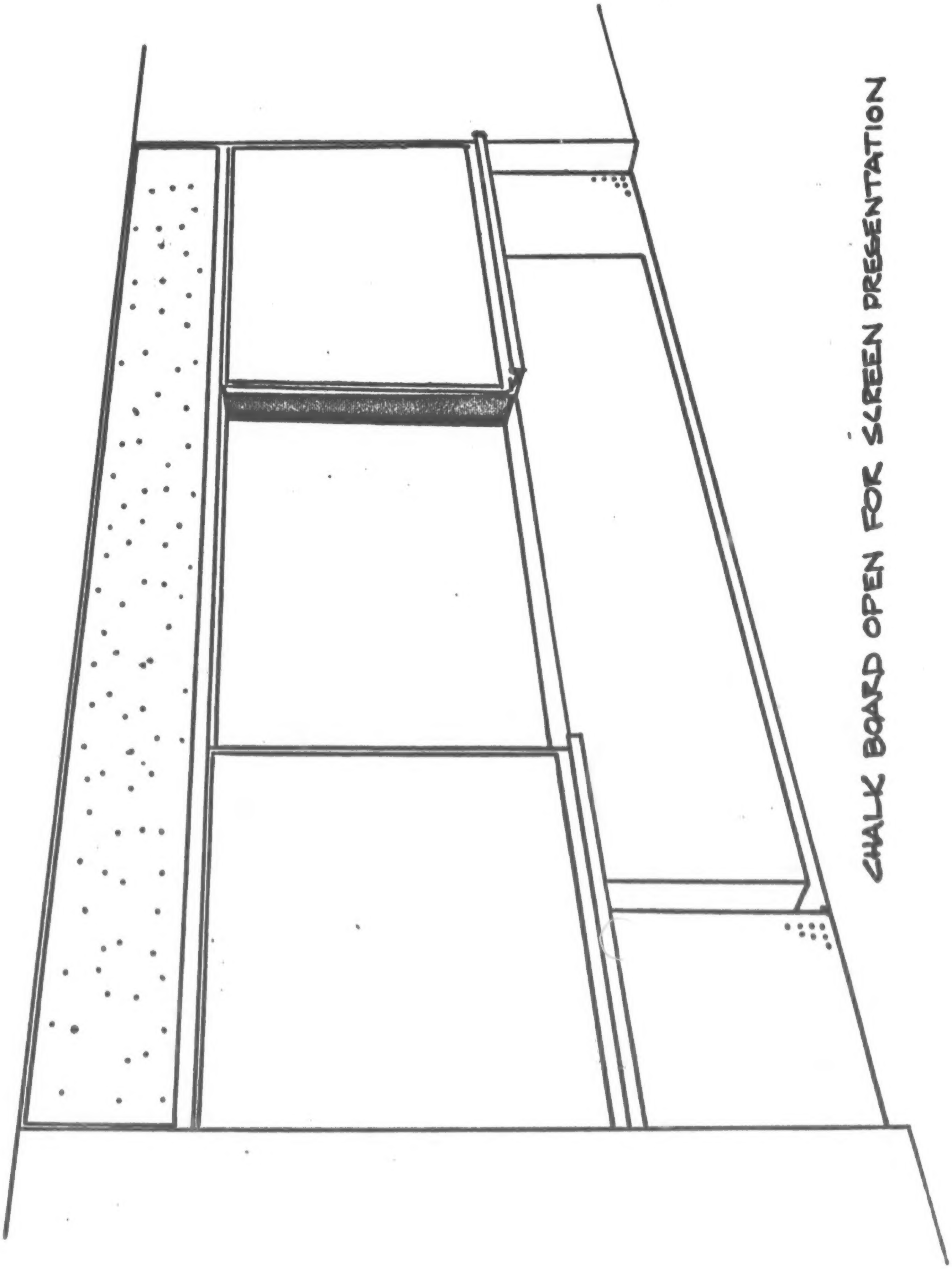

8'-0"
28
14'-0"
TACK BOARD
PEG BOARD
CHALK BOARD
SPEAKERS
PEG BOARD

SCALE: 1/2" = 1'-0"

1


CHALK BOARD SURFACE TILTED 11°

1



CHALK BOARD OPEN FOR SCREEN PRESENTATION

2. TEACHING STATION

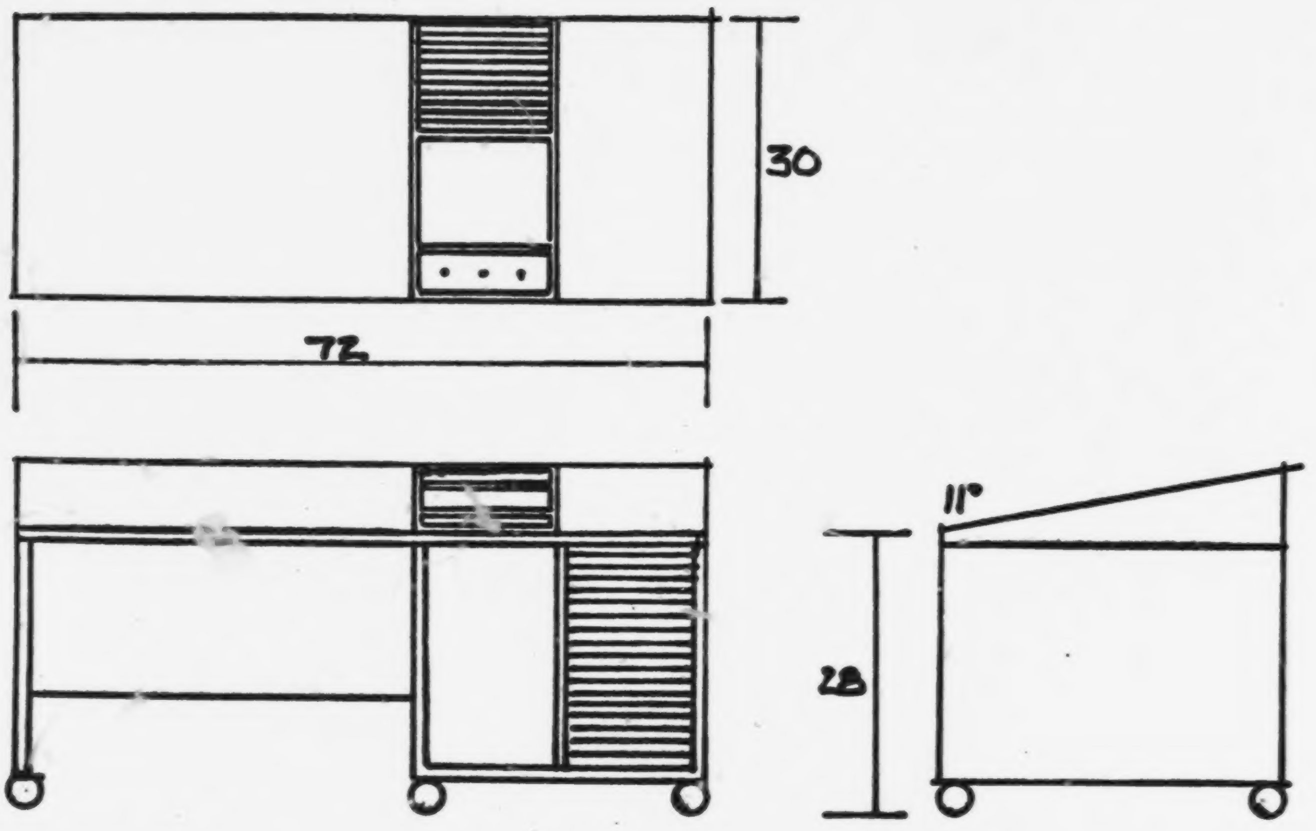
The traditional concept of the teacher's desk must be reexamined in light of the provisions for a separate teacher's office and demonstration table. The desk is no longer required to serve as a general book and supply storage or necessarily as a platform for three-dimensional displays. Conversely, there are indications that the present desk serves as a barrier between the teacher and students, physically and psychologically. However some work surface is needed for supporting notes and other reference materials for lectures, and where needed to provide a base for overhead projection.

The present solution is a mobile unit which may be moved into position as needed and stored elsewhere in the room for general or demonstration activities. Because most of the storage function is eliminated the unit is smaller and structurally more open, aiding in freedom of movement. The work surface may be tilted to provide an inclined work surface for better reading and writing. The overhead projector, built into the work surface, is convenient for operation but may be retracted when not in use. This provides a continuous work surface and seated operation of the projector, while offering added convenience in storage and security.

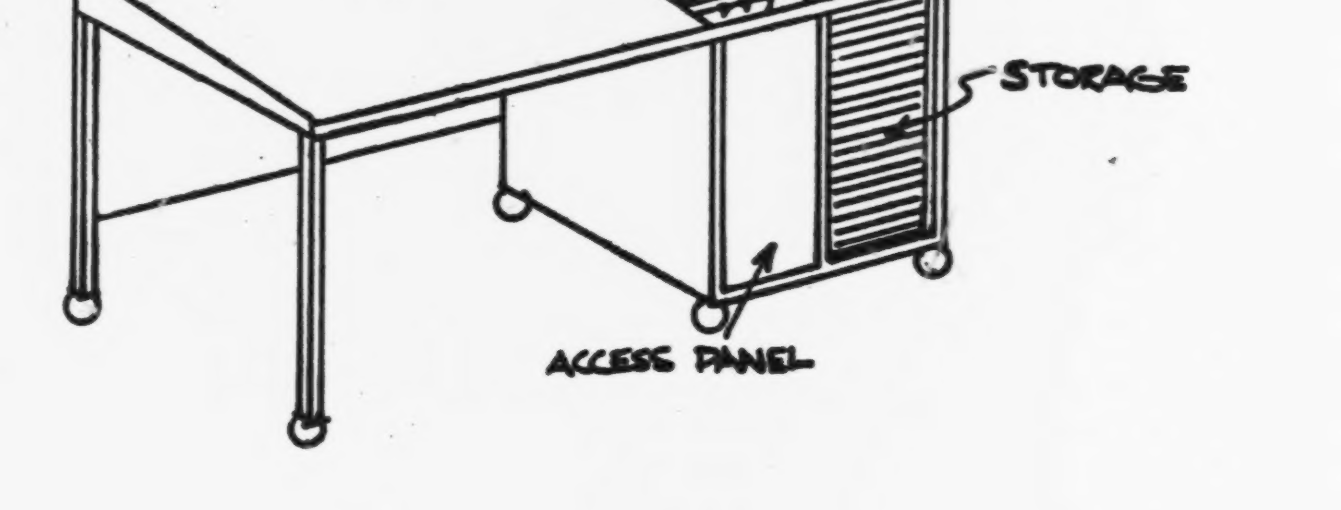
The teaching unit is intended for primary use with the audio-visual unit, but may be used with the demonstration table or located in another part of the room for conference purposes or projection.

2

TEACHING STATION



SCALE: ½" = 1'-0"


RECTRACTABLE OVERHEAD PROJECTOR
11° TILTED SURFACE
STORAGE
ACCESS PANEL

3. SCREEN UNIT

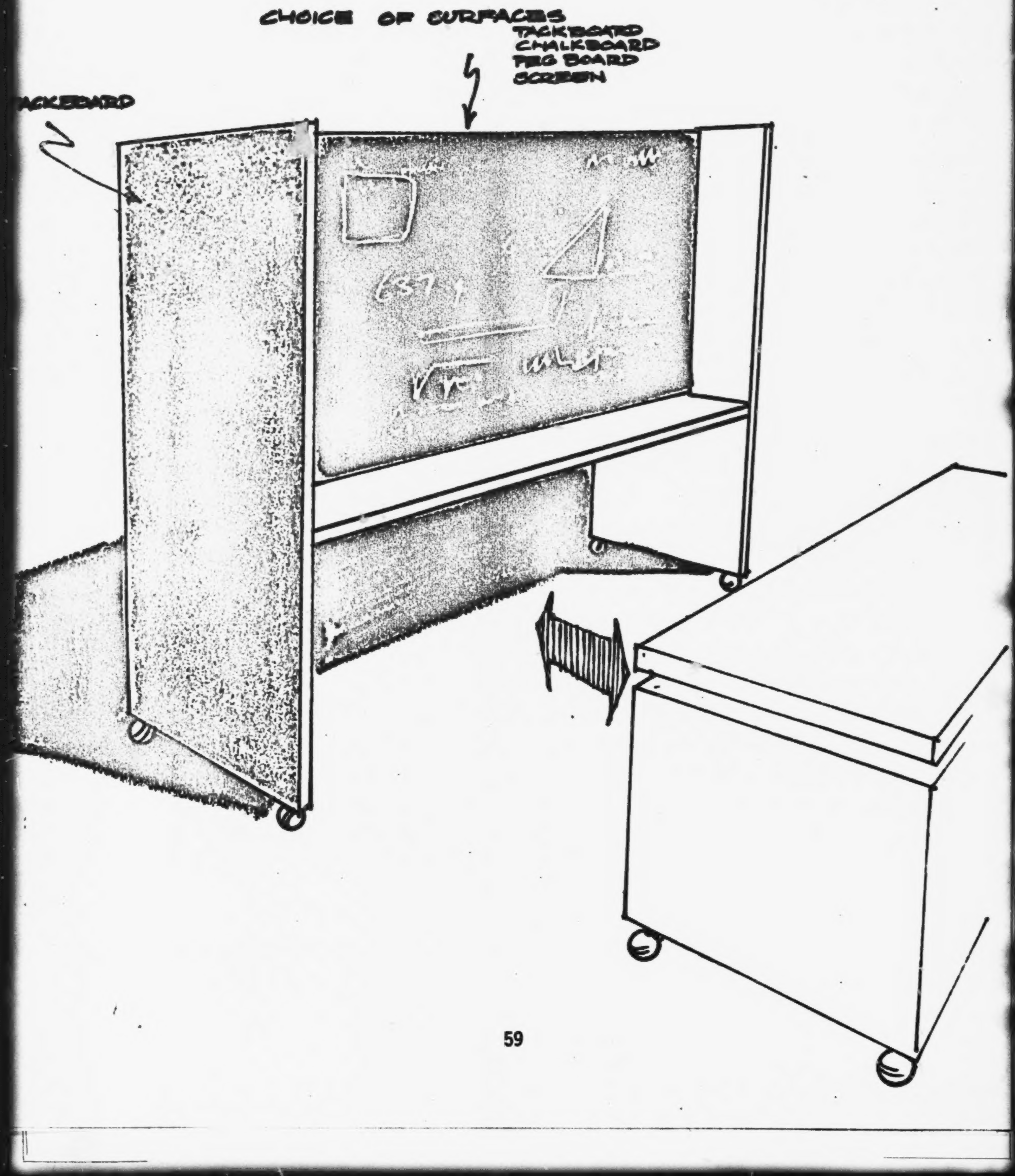
One of the major difficulties in providing windows in the classroom is the effects of glare caused by the bright exterior against the lower intensity of artificial illumination. This is particularly apparent in the lecture situation where strain is caused by a strong light source to the side while the student is trying to concentrate at the front of the room. Another factor is visual distraction in the peripheral field of vision during concentrated viewing which may be independent of light intensity. There is a need therefore to screen out window light and work areas with a homogenous surface.

The screen unit as designed is a free standing unit fitting over the demonstration and work tables as a screen between the vision strip and the presentation area. While fulfilling a critical visual function, the unit contributes to the general educational facilities in providing additional chalkboard and tackboard space as well as work and display surfaces. Its mobility allows it to be used as a chalkboard or display resource for small group work and as a movable space divider.

As mentioned, the two screen units are intended to slide over the display and work tables to form a continuous divider. While in place, the two tables may be freely pulled out into either the presentation or construction areas or moved to the center of the room. The flexibility of their use allows them to be moved to the display area for exhibits, located in the construction area for additional work space or grouped with desks and chairs for small group work.

3

SCREEN UNIT


CHOICE OF SURFACES
TACKBOARD
CHALKBOARD
PEG BOARD
SCREEN
ACKBOARD

4. DEMONSTRATION CART

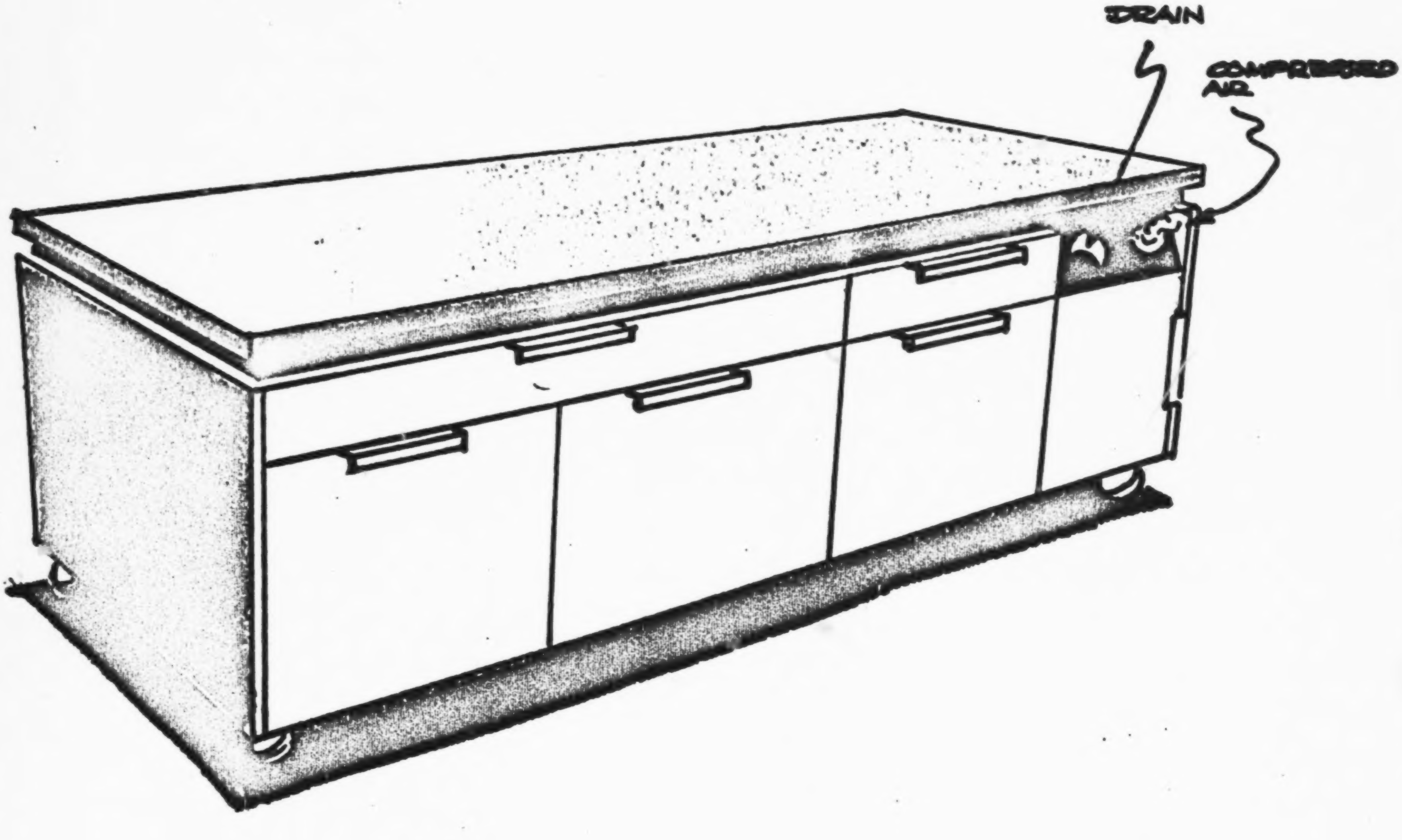
The curriculum development for the fifth grade indicated the need for scientific data and experience, which is facilitated by an extensive program of classroom experimentation and demonstration. In many cases this is limited by the availability of proper facilities. This problem can be approached by providing a demonstration table and sink combination which can provide the resistant work surface, mountings for apparatus and necessary utilities for performing a variety of experiments. Such a unit is also useful for construction projects and individual or small group exploration. An important consideration for this unit is mobility, allowing for the unit to be used at the front of the room with the chalkboard facilities and providing for relocation in the construction area for special projects.

The unit which is specified includes an acid, chemical, and waterproof work surface with a low reflectance of 30% specified to avoid visual problems. Space underneath the work surface can be used for an auxiliary drain and containers of compressed air, distilled water, gas, etc. Ample storage space for scientific apparatus is also provided. Additional modifications may include brackets and mounting holes for setting up apparatus on the work surface. An advantage of this free-standing unit is its use for small group demonstrations, permitting students grouped around the cart perimeter.

The demonstration cart is intended for use with the adjacent sink, either parallel to the dividing line or drawn into the presentation area. Combinations may also be made with the screen or teaching units and the work table.

4

DEMONSTRATION CART


DRAIN
COMPRESSED AIR

5. BOOKSHELF

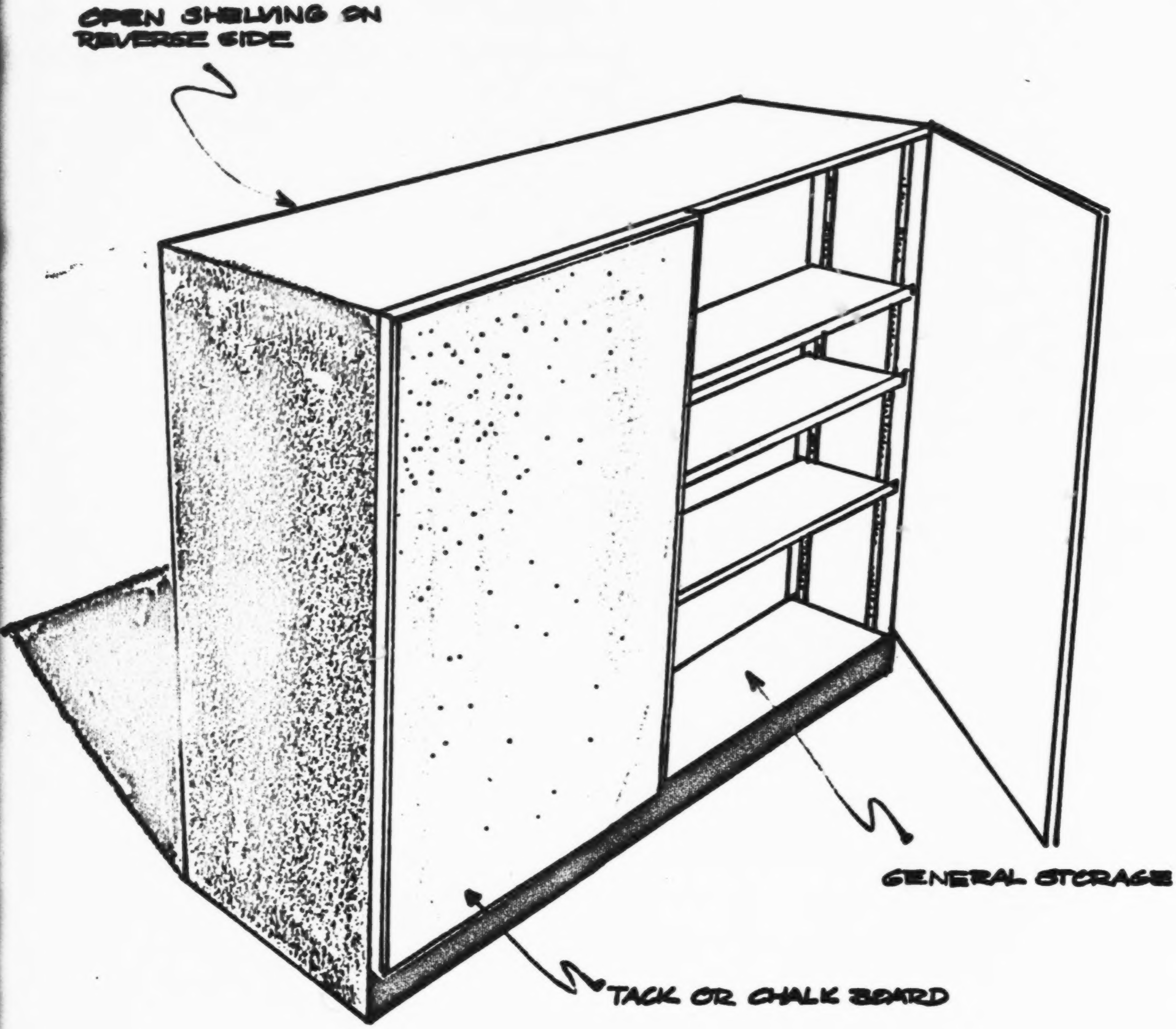
The major requirements for the independent study area are visual and auditory isolation and ample storage space for books and reference materials. A secondary requirement in the presentation area is supplemental tackboard space and storage for teaching aids and educational materials. As before, some degree of mobility is desirable to provide flexibility in room arrangements.

The bookshelf which is provided is a semi-permanent room divider including shelf space on the side facing the independent study area and cupboards on the presentation area face. The doors are covered with either a tack or chalk surface. This provides the broad base needed for a free standing unit while metal runners on the under surface allow the unit to be moved when necessary without damage to carpeting. All shelves are adjustable and the door panels may be interchangeable. An important aspect of shelf height and material location in the independent study area is the ability to use the students' desks with the shelving to provide a reference work surface.

The use of student desks with this unit is described above. Additional groupings may include the map and audio-visual carts for small group use. When groups are using the independent study area it may be necessary to move the two units somewhat to open up the space. The units may also be regrouped with each other for special arrangement.

5

BOOKSHELF AND TACKBOARD UNIT


OPEN SHELVING ON REVERSE SIDE
GENERAL STORAGE
TACK OR CHALK BOARD

6. MAP CART

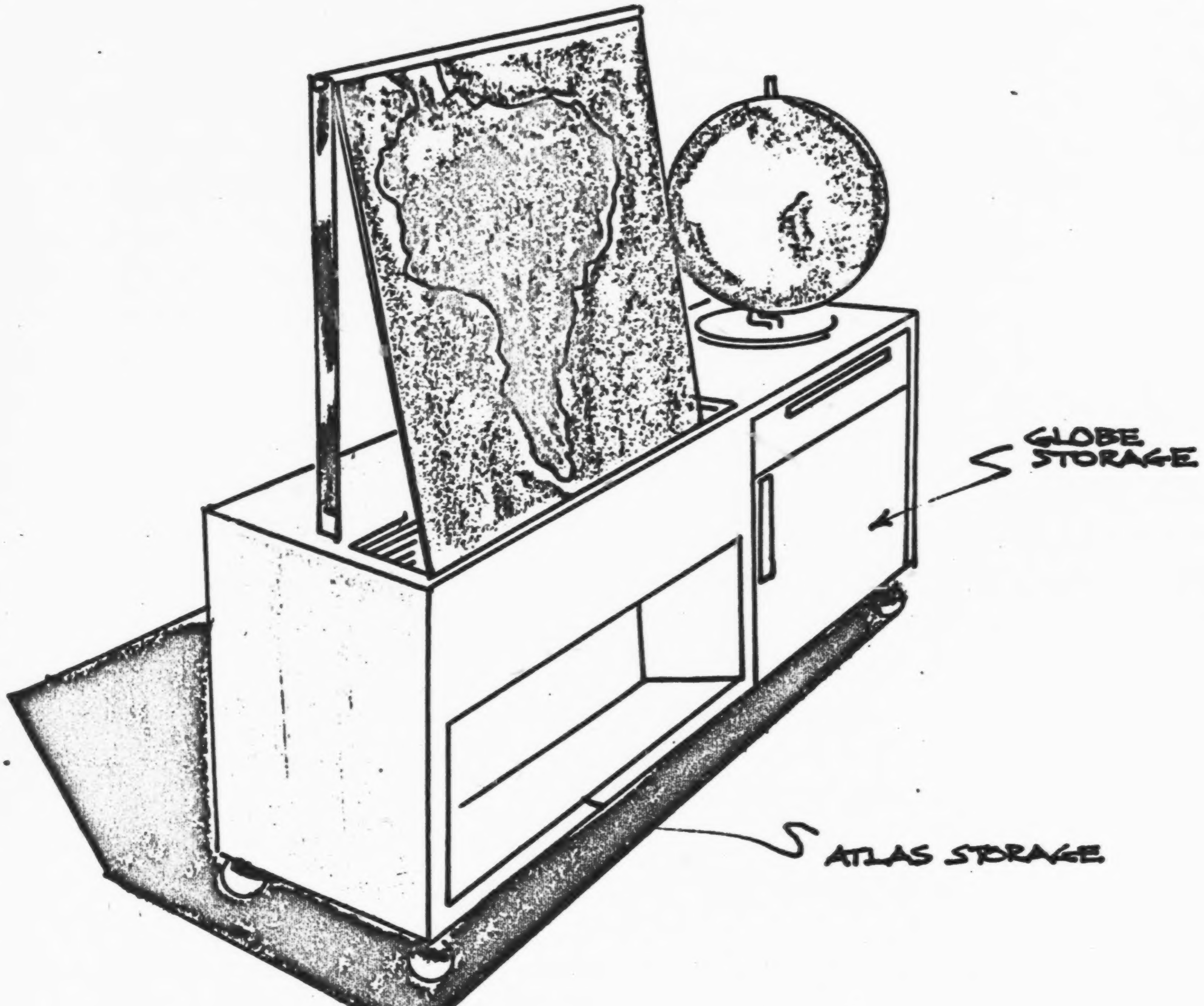
With the improved viewing conditions and small group work in the classroom; and with the additional factor that visual strain occurs when viewing an elevated source, the concept of wall or chalkboard hanging maps becomes less satisfactory. Additional factors of convenience are possible when maps are mounted for easy reaching and writing while displayed and when maps can be used in different locations in the room. While there are in current use free-standing chart and map racks, these usually have size and manipulation limitations and may be unstable, particularly if the teacher wishes to add explanatory symbols and diagrams over the map surface. It is also advisable to have supplementary reference sources such as globes and atlases available when doing map work.

The projected solution for this specification is a map cart in which rolled maps are mounted in the map cart and displayed by pulling upward and hanging on an overhead support. Spring steel tapes may be used for the hanging support and then collapsed on rollers for storage. Mounting the maps vertically in the body of the cart should allow for a sufficient number of maps to be stored within a relatively shallow cart width. Additional storage on the cart may be provided for globes and atlases. The cart can be moved around the room as needed. A transparent sheet incorporated on the overhead support will allow for overlaying annotation. Writing materials would be stored in the cart.

The map cart would normally be stored in the independent study area as a source for individual reference and as a temporary partitioning for the teacher's office. For large group use the cart would be moved into the presentation area and used either individually or in conjunction with the teaching station or demonstration table. When needed the cart may also be used temporarily in the display area or elsewhere in the classroom for group work.

6

MAP CART


GLOBE STORAGE
ATLAS STORAGE

7. AUDIO-VISUAL CART

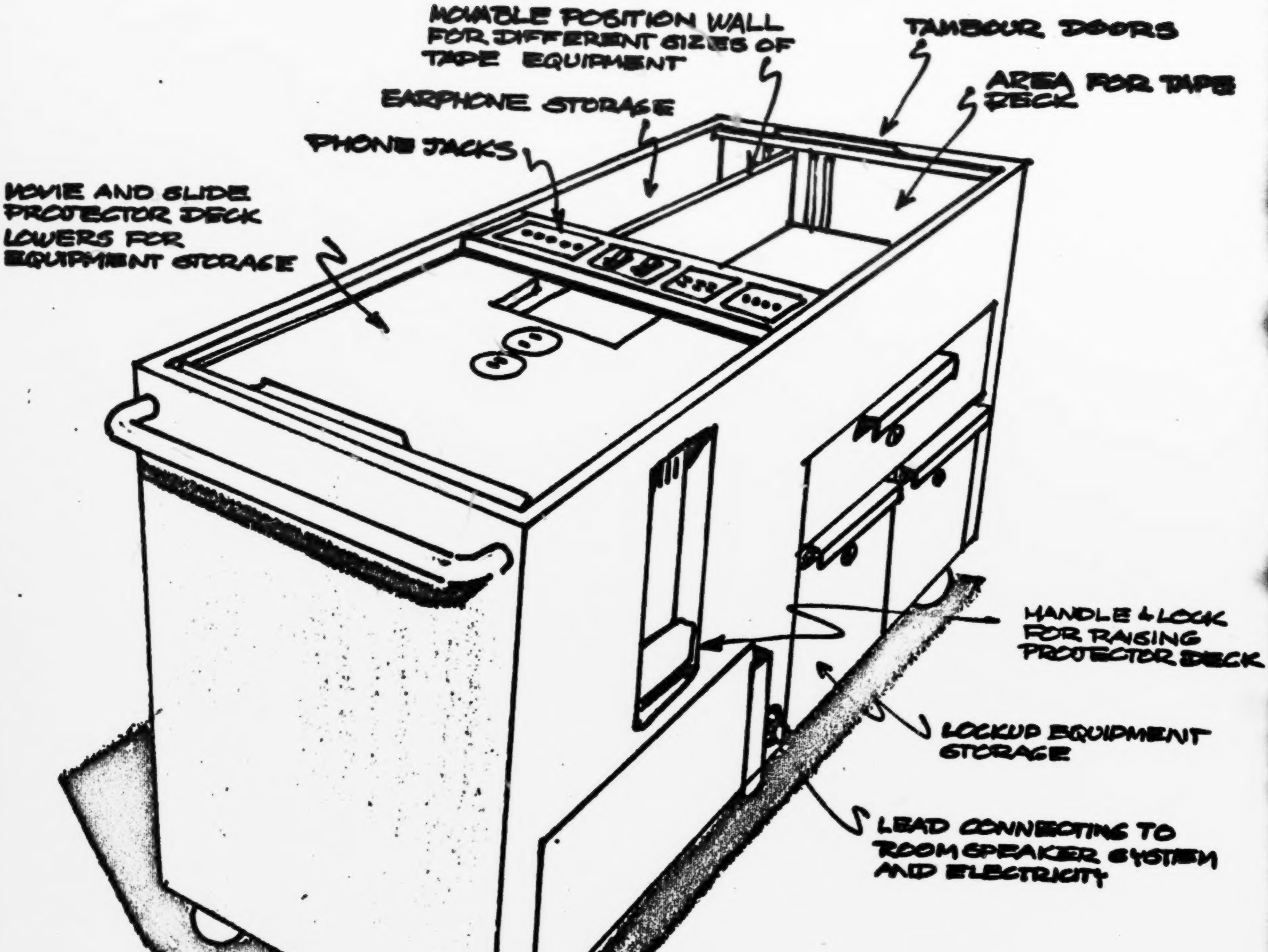
As the curriculum and teaching methods are advanced to higher stages of development, the emphasis on audio-visual aids is increasing. While the use of this equipment has expanded, the problems in working with this equipment have increased in the scale and complexity of equipment, the storage and manipulation problems and the integration and coordination of different audio and visual components. Of particular interest is the mobility of this equipment for use around the room with proper input, output, and support facilities and the duplication of standard components in many separate pieces of equipment.

The use of a multi-purpose audio-visual cart is intended to minimize some of these problems. This cart is designed to function under alternative situations depending upon whether the major pieces of equipment are stored in the room or in a central school equipment storage and whether it is possible to design equipment to use a common sound amplification system. In either case the cart serves as a mobile base of support and storage for a variety of audio-visual equipment with common connections from the cart for electrical power and speaker distribution plugged into either wall or floor outlets. Jacks and connections are provided so that equipment may be attached to the cart power source and to allow either speaker or earphone listening. In the ideal situation tape and record players and motion picture, slide, and filmstrip projectors would plug in as components to the cart, using a common sound amplification system in the cart. Storage, transportation, and cost problems would be reduced. Such a component system would also facilitate the simultaneous or multi-media use of different pieces of equipment.

The cart, which is normally used as an additional partition to the teacher's office, may be moved about the room to different locations depending upon screen size and large and small group use. An important function would be audio-visual or audio use by individuals or small groups in the independent study area using earphones and a small screen. The equipment is also available for teacher previewing.

7

AUDIO-VISUAL CART


MOVABLE POSITION WALL FOR DIFFERENT SIZES OF TAPE EQUIPMENT
TAMBOUR DOORS
AREA FOR TAPE DECK
EARPHONE STORAGE
PHONE JACKS
MOVIE AND SLIDE PROJECTOR DECK LOWERS FOR EQUIPMENT STORAGE
HANDLE & LOCK FOR RAISING PROJECTOR DECK
LOCKUP EQUIPMENT STORAGE
LEAD CONNECTING TO ROOM SPEAKER SYSTEM AND ELECTRICITY

8. TELEVISION UNIT

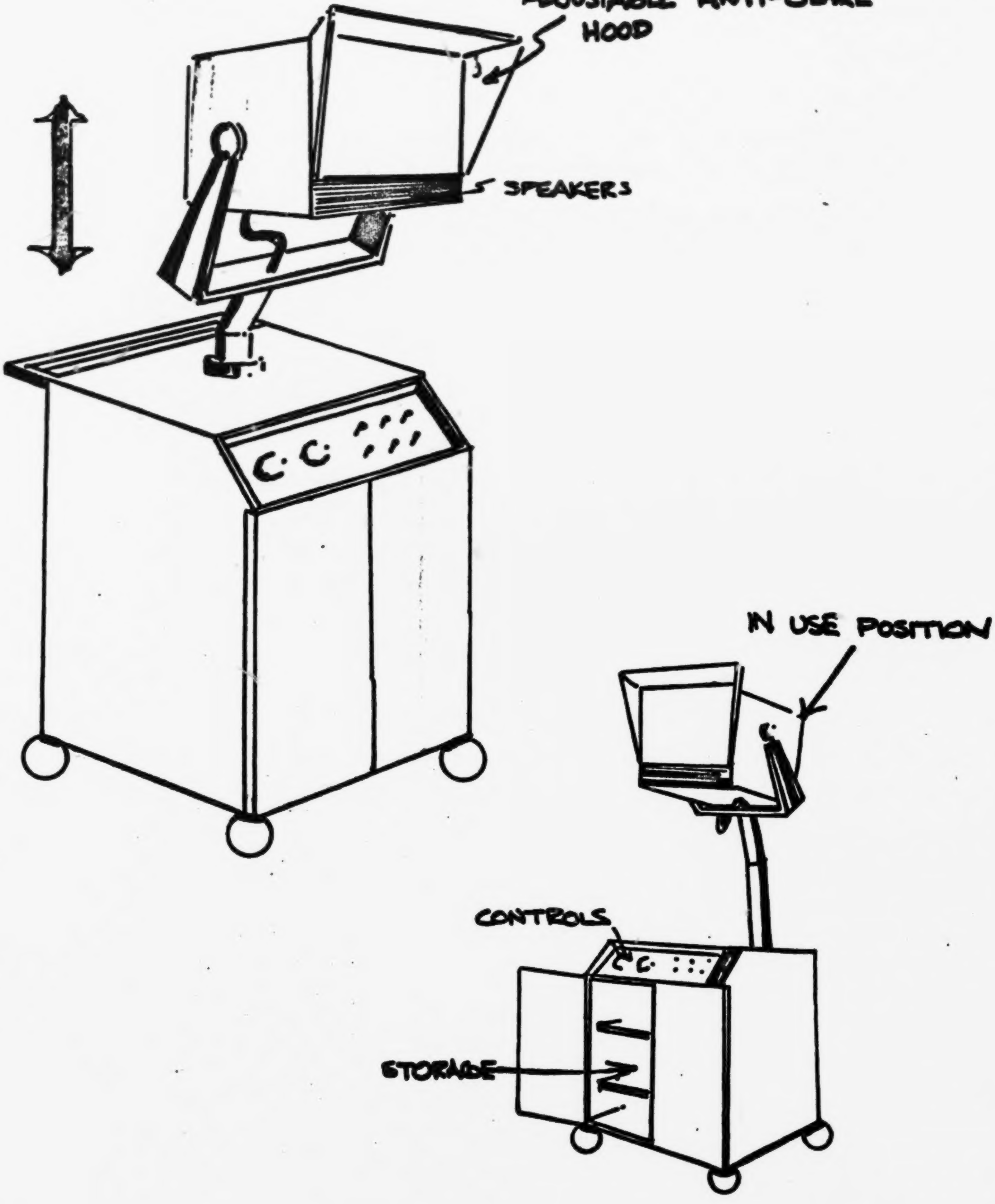
Visual problems related to elevated viewing sources discussed with the map cart also apply to television, and flexible room use precludes the use of fixed mounting television sets. The television receiver should be elevated somewhat within a comfortable visual angle, but the controls should remain within convenient reach. One difficulty, however, with elevated mobile television equipment is instability due to a high center of gravity.

The present unit, which was developed originally for educational television, includes a mobile free-standing base, with an adjustable receiver height so that it can be lowered for moving. Additional factors include an adjustable anti-glare hood and provision of alternate room or unit speakers or earphones. The controls located on the base of the unit allow easy access. Storage is included for additional earphones, overlays, or other teaching aids.

This unit is also stored in the independent study area for use by small groups with earphones but may be moved to the presentation area or other locations as needed. Where feasible an additional, fixed receiver may be premounted in the audio-visual unit behind the projection screen.

8

TELEVISION UNIT


ADJUSTABLE ANTI-GLARE HOOD
SPEAKERS
IN USE POSITION
CONTROLS
STORAGE

9. WORK TABLE

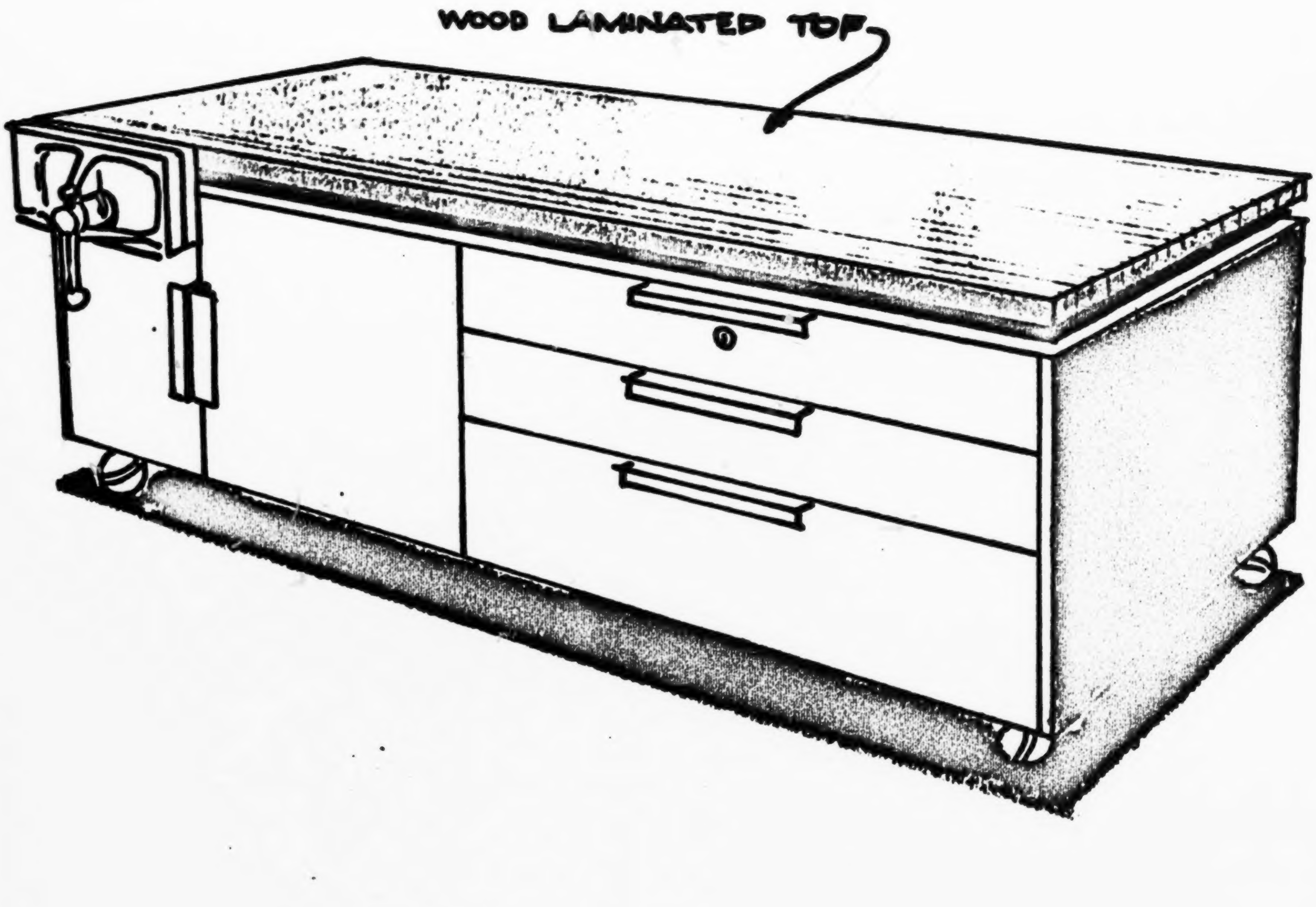
While it is assumed that there may be separate shop facilities elsewhere in the school building, there will generally be some construction occurring in the classroom. A work bench should be provided for such purposes with a surface which can be freely worked on and enough mobility to allow placement in different room locations. This should be the major construction work area, and it should contain storage and other facilities to support the work.

The work table is designed to slide under the second screen unit as part of the division between the construction and presentation areas from which it could be pulled out to use in either area. A laminated wood surface is provided with a vise and storage accessible from either side. Extensions may be provided to pull out from beneath the work surface to allow for seated work at the table.

The unit would generally be used free-standing but might be combined with the demonstration cart or screen unit or be used with the work area above the lockers. Chairs or stools could be used for working or the table could be used to supplement the display facilities.

9

WORK TABLE


WOOD LAMINATED TOP

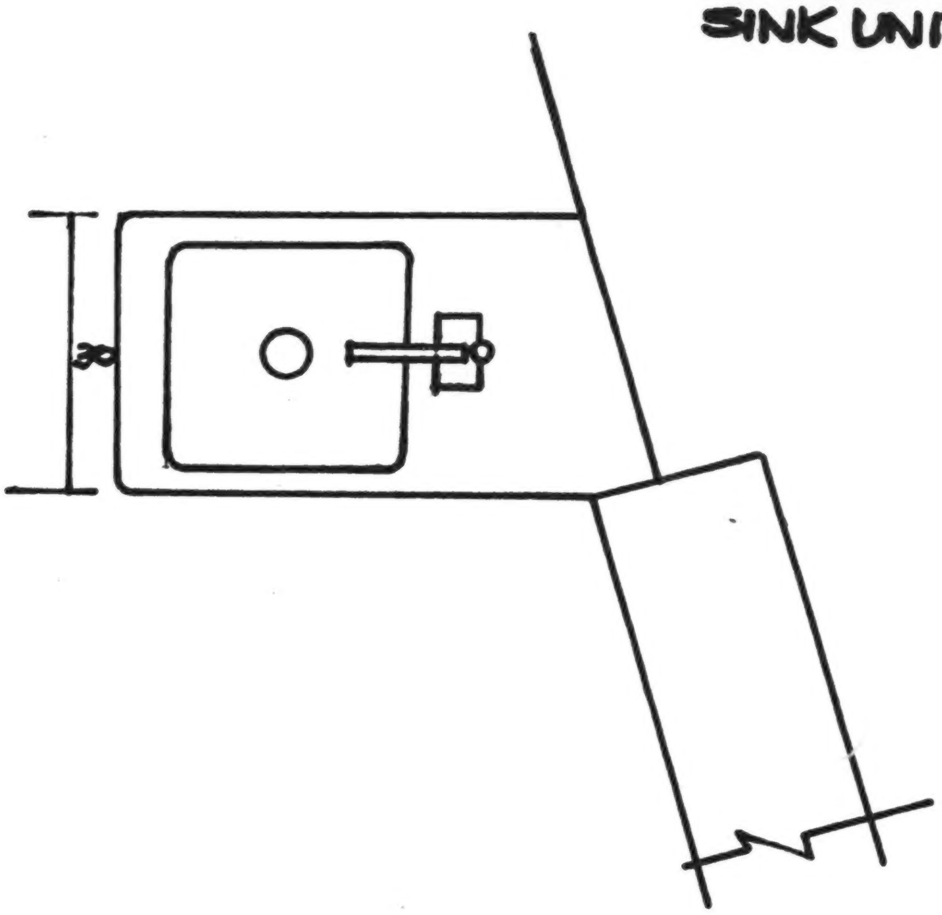
10. SINK UNIT

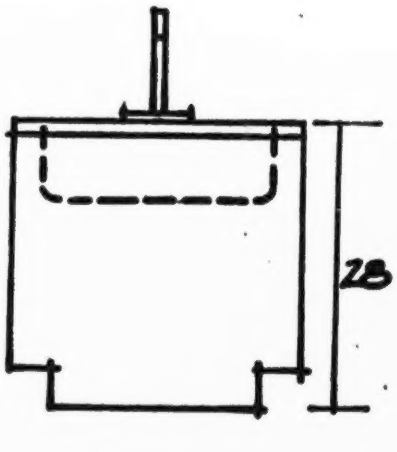
In frequent practice the fifth grade classroom may either lack a sink or be provided with a sink in a relatively inaccessible corner of the room. However, as the emphasis on experience through art and construction activities increases; and as the interest in science grows, there is a need for a conveniently located sink to serve a multitude of functions. Such a unit should be centrally located to provide access for both science demonstrations in the presentation area and cleaning and other purposes in the construction area. Access to both areas is also so important for construction activities which may need water. The sink should be large enough for several students to use at one time. (This is facilitated by a double access). Controls on the sink should be designed for convenience and for use with either slippery or soiled hands.

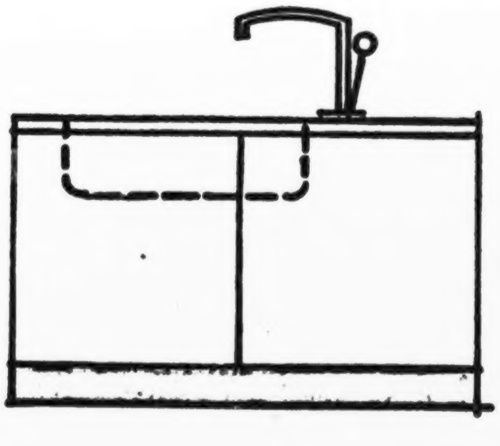
The sink which is provided is located centrally and allows access from both construction and presentation areas. A single tub is used with the controls removed from the more concentrated work areas adjacent to it. The single lever control allows easy manipulation where precise regulation is not essential. The water supply should be controlled to avoid extremes of temperature and pressure; the waste disposal should be equipped with a plaster trap. Storage for cleaning and other supplies is located below the sink, accessible from both sides.

This unit is located along the division between the presentation and construction areas, adjacent to the audio-visual wall. With the audio-visual wall this forms the only permanent division of the larger multi-room teaching space. The sink shares plumbing services with the adjacent room. This sink may be used in conjunction with other mobile units, particularly the demonstration cart, which may if feasible, be connected directly to it.

10
SINK UNIT







11. LOCKERS (not shown)

Storage and work space are always of primary concern in the classroom. Work space is needed in the construction area for project work and display. Storage is needed for large sheets of art materials. In addition, it may be advisable to have in-room storage for individual students' personal belongings and art and demonstration supplies to supplement space available in the desks and wrap storage area.

The solution to this problem is a locker unit located in the construction area beneath the vision strip. This would include a counter for construction activities, shallow drawers for art supplies under the counter, and two rows of 14 lockers to accomodate 28 students, in the base of the unit. These lockers would be partitioned but with open fronts to allow easy access. Note that while this classroom is specifically designed for a maximum of twenty-five students, that provision should be made to allow a minimum excess.

Since this work area is adjacent to the vision strip it should not be generally used for major construction activities, but it may supplement other work surfaces such as work or demonstration tables and student desks. This unit is relatively permanent and should be considered as an extension of the exterior wall.

12. ART STORAGE (not shown)

As has been mentioned, classroom storage can be an important problem, and if art and construction activities are to be facilitated ample space should be available for storing raw materials and smaller incompleted projects. With this in mind, it is advisable to provide an additional unit for this purpose.

The art storage cabinet should be as spacious as the room layout allows, however, it should not exceed the height of the continuous vision strip in the construction area so that it may be stored along that wall. Cupboard doors, drawers, shelves, or bins may be furnished as they are appropriate to the anticipated materials. The unit would be mobile for use in different areas of the room and construction area, and the top surface should be adaptable for work or display.

Again, this is one of the several mobile components which may be regrouped around the room as required for specific activities. It would be most commonly used with the work table or in the display area.

13. ZOOLOGICAL UNIT

One of the questions which has influenced design decision-making throughout this project is the degree to which activities are avoided or minimized due to the lack of proper facilities. The aim of this project is to provide facilities not only to support specialized activities, but also some of a more generalized nature which may be adapted to a variety of purposes. In short, the environment which is provided should support to the fullest extent an imaginative and varied teaching program. A particularly appropriate example of this is the zoological unit.

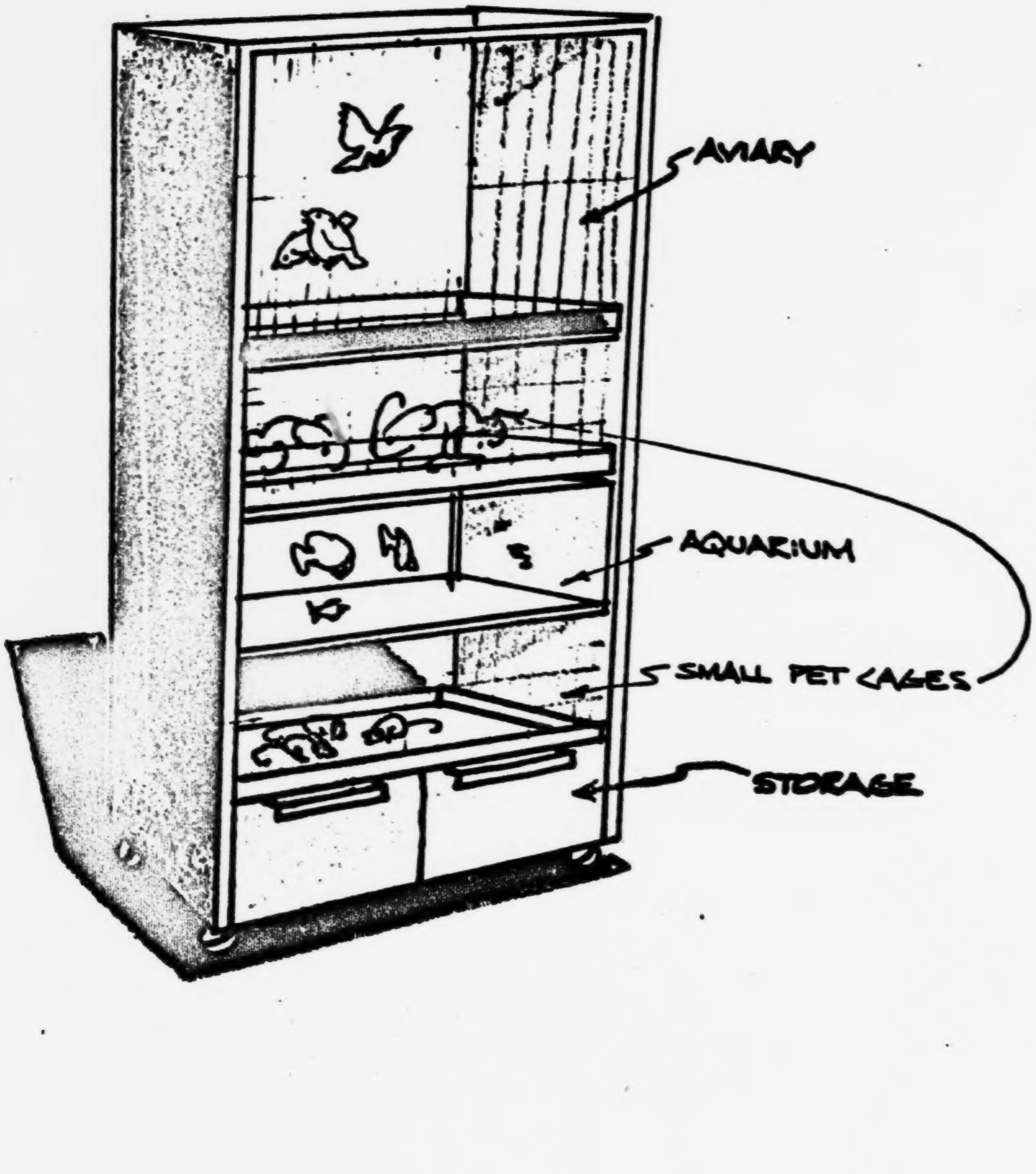
Fifth grade students learn by observation and application of knowledge. This is clearly seen in the use of various animals within the classroom for instructional purposes. There are difficulties, however, in providing proper shelter and care for the animals. This can affect the health and well being of the animals, but even more important is the distraction and inconvenience for the teachers and students in the use of makeshift arrangements. An important factor in colder climates is the fluctuation of building temperature which may be lowered over evenings, weekends, or vacations as an economy measure.

The unit which is provided includes several advantages; using flexible modules the unit may be divided into many different types of cages to hold a variety of animals in the one space, and its size offers more freedom of choice than other standard cage units. Also included are facilities for feeding and cleaning and auxiliary heating with lamps or tubes. Storage is provided for food and grooming supplies. The mobility of this unit is important in allowing the cages to be moved about the room for demonstration and study. This provides the convenience of a standardized unit with flexibility and mobility to facilitate classroom use.

The zoological unit is generally used with the similar Botanical unit to form a science center adjacent to the vision strip allowing for some natural lighting. For demonstration purposes this can be moved into the presentation area for use with charts or lectures. The unit may also be moved to the sink for cleaning and feeding, or relocated in the display area or out-of-doors.

13

ZOOLOGICAL UNIT


AVIARY
AQUARIUM
SMALL PET CAGES
STORAGE

14. BOTANICAL UNIT

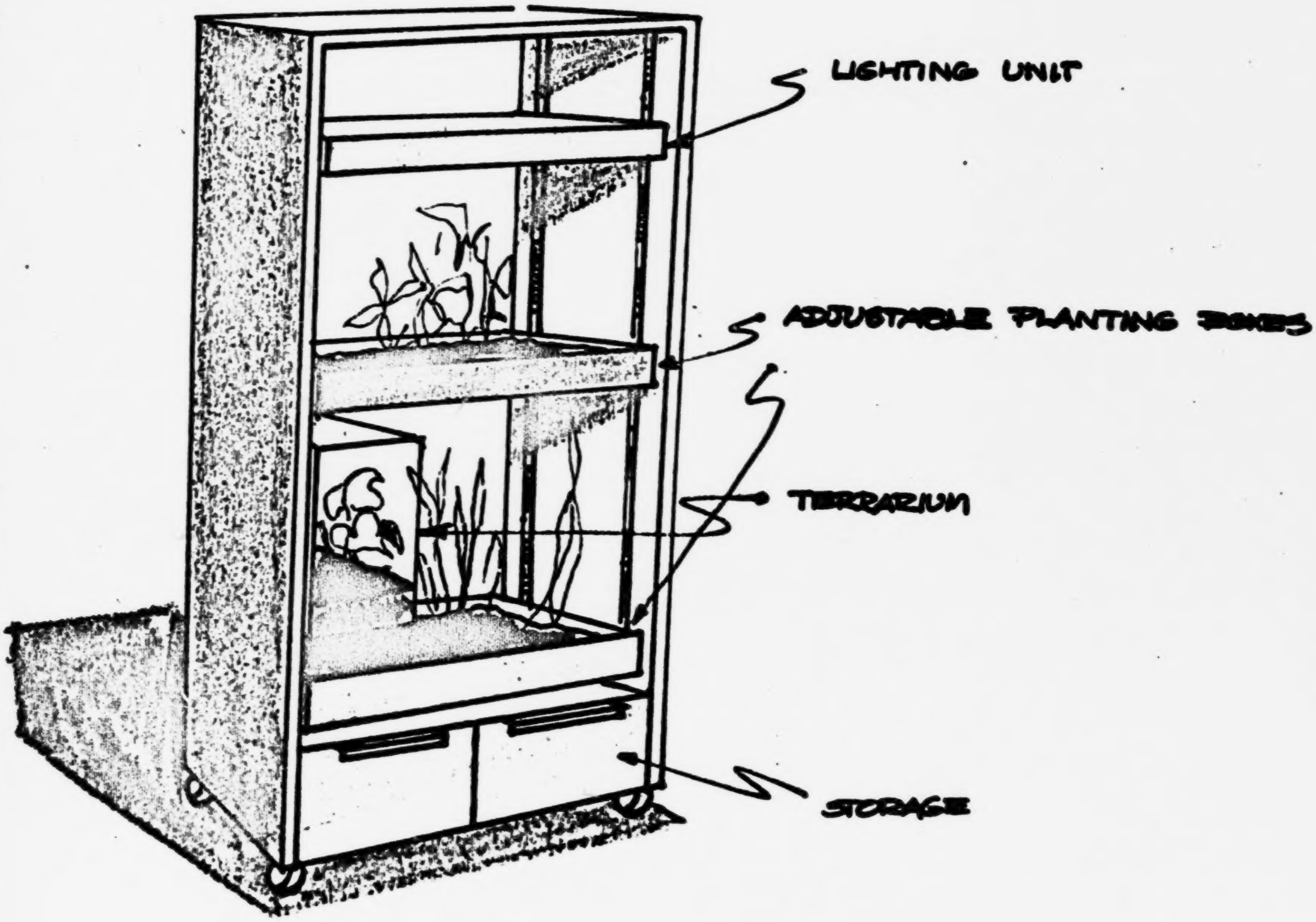
Factors affecting the botanical and zoological units are in many ways similar. The problem is to increase the convenience of using botanical exhibits and to promote their use in the classroom. Criteria for this unit include mobility, standardization, heating and light, watering and cleaning, segregation of specimens and flexibility of use.

The unit includes trays, lighting units and other apparatus which can be arranged in a variety of configurations. Important features are a combination tray and planter inset to allow for moisture control and adjustable subdivisions for the planting trays for different specimens and comparative studies. Cups and jars may also be placed in the trays for comparison or individual specimens. The adjustability of trays and mobility of the unit provide for a variety of teaching situations. Storage is included for tools and plant food. A gro-lamp-type light may be accomodated.

Again, this unit may be used in different groupings and situations, although it may be kept near the vision strip to utilize natural light. Its construction also allows for indoor-outdoor use.

14

BOTANICAL UNIT


LIGHTING UNIT
ADJUSTABLE PLANTING BOXES
TERRARIUM
STORAGE

15. DISPLAY WALL (not shown)

While it may be advisable to provide for a movable partition between adjacent classrooms to allow for multi-class sessions, this may entail problems which call for special consideration. The major problem lies in the creation of the situation where one of the longer walls should be operable for joining the rooms, but at the same time it is not feasible to sacrifice a large extent of vertical teaching space. In this solution the problem is even more critical since this wall serves as the display area where display panel space is needed. It is also important to consider the physiological advantages of working on an inclined vertical surface. In addition, the rear wall of the presentation area has an important function in room acoustics.

The unit consists of a folding wall in four foot modular sections. This allows for a solid backed mounting surface for either chalk or tack board, which can be folded back out of the way for interclass sessions. Features include a hinged work surface which can be inclined to the proper angle, and a folding chalk tray which can be retracted for storage. Hanging facilities allow for the accommodation of interchangeable display panels. When chalkboard panels are in place this provides a large area for student work or big muscle drawing activity. Tack and pegboard panels would minimize reverberation from the rear wall. Metal backing on the chalkboard panels would permit the use of magnetic fasteners. Thus the folding wall would provide facilities for a variety of teaching and display activities.

This large area of vertical teaching surface would supplement the smaller areas in the presentation space and elsewhere. It would be ready for display and dramatic and other demonstration use as needed. This can also be used in conjunction with other units when large vertical areas are needed.

16. PANEL STORAGE (not shown)

Although ample space is provided for storage of materials, supplies, and apparatus; larger and bulkier items must also be stored in the room. This includes the different display panels, easels and folding tables, large construction materials and supplemental display and work equipment. A unit for this function should be semi-permanently located due to size, and should be adjacent to the display wall.

The panel storage unit should be large enough to accomodate the variety of room equipment, and should be provided with the necessary racks and shelving, while allowing convenient access to the materials. Doors or other closures may be located on either the front or sides.

The unit should be located adjacent to the display wall and area and should also be accessible to either the construction or presentation areas. It would also be convenient if this unit could be readily available to the exterior exit to facilitate the storage of large materials.

17. PAINT CART (not shown)

While paint and other wet construction materials are needed in either premixed or dry form, their storage, preparation and cleaning may often present special problems in contamination of other materials and work surfaces. It would be advisable to have a separate storage unit for these materials which could be brought to the sink for mixing and cleaning and then moved to the appropriate work area for use. This would allow for centralization of like supplies while providing isolation from other materials.

The solution which is suggested is a paint cart containing either jars or bins for materials and storage for related supplies. This should be small enough to be stored next to the sink and have the capability of being moved into the work areas as needed. Facilities might include soaking tanks for brushes and storage for paint rags, with removable containers for cleaning. It is also important that the edge of the top work surface be raised to minimize accidental spillage.

This unit could be kept by the sink or used with the locker counter or with demonstration or work tables. It might also be moved to the display or presentation areas for special projects, or taken out doors.

18. STUDENT DESK

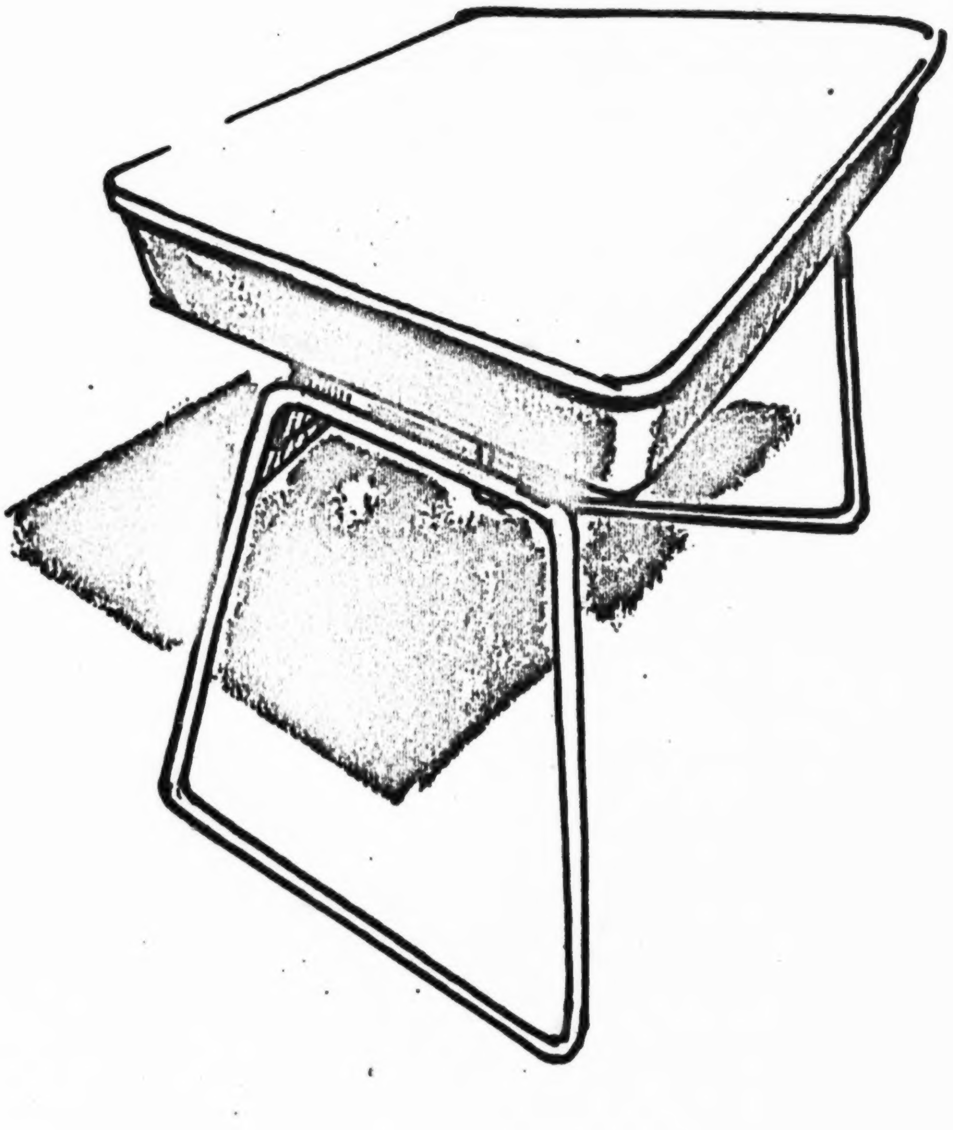
There are certainly as many different solutions to the student desk as there are manufacturers and there may be somewhat more than that. In essence a relatively simple problem, there are a number of variables which must be taken into consideration. The most important factor is the inclination of the writing surface to an optimum of 20° to minimize physiological strain in two dimensional writing tasks and the option of a vertical surface for general and three-dimensional construction use. Physiological factors are also important in using a storage bin under the writing surface; since this may be convenient it should not interfere with the student's knees or thighs when he is under the desk. Some adjustability in height is necessary to accommodate children of different stature. Problems of desk movement and manipulation are also important in the flexible classroom. The question of shape of the desk top related to grouping is discussed on the following pages.

The desk which is provided includes an inclined work surface, a tapered storage bin for knee space, and a limited height adjustment where the desk top joins the base. The use of tubular legs reduces weight and cost and allows for movement over a carpeted floor. In contrast to some solutions the desk is neither fixed to the floor nor joined to the seat in keeping with the flexibility of function.

The desk provides a personal work space and storage for each student and is used for a variety of functions: in a large group presentation, rearranged for small group work, taken into the independent study area for research and occassionally used for display or construction surfaces.

18

DESK

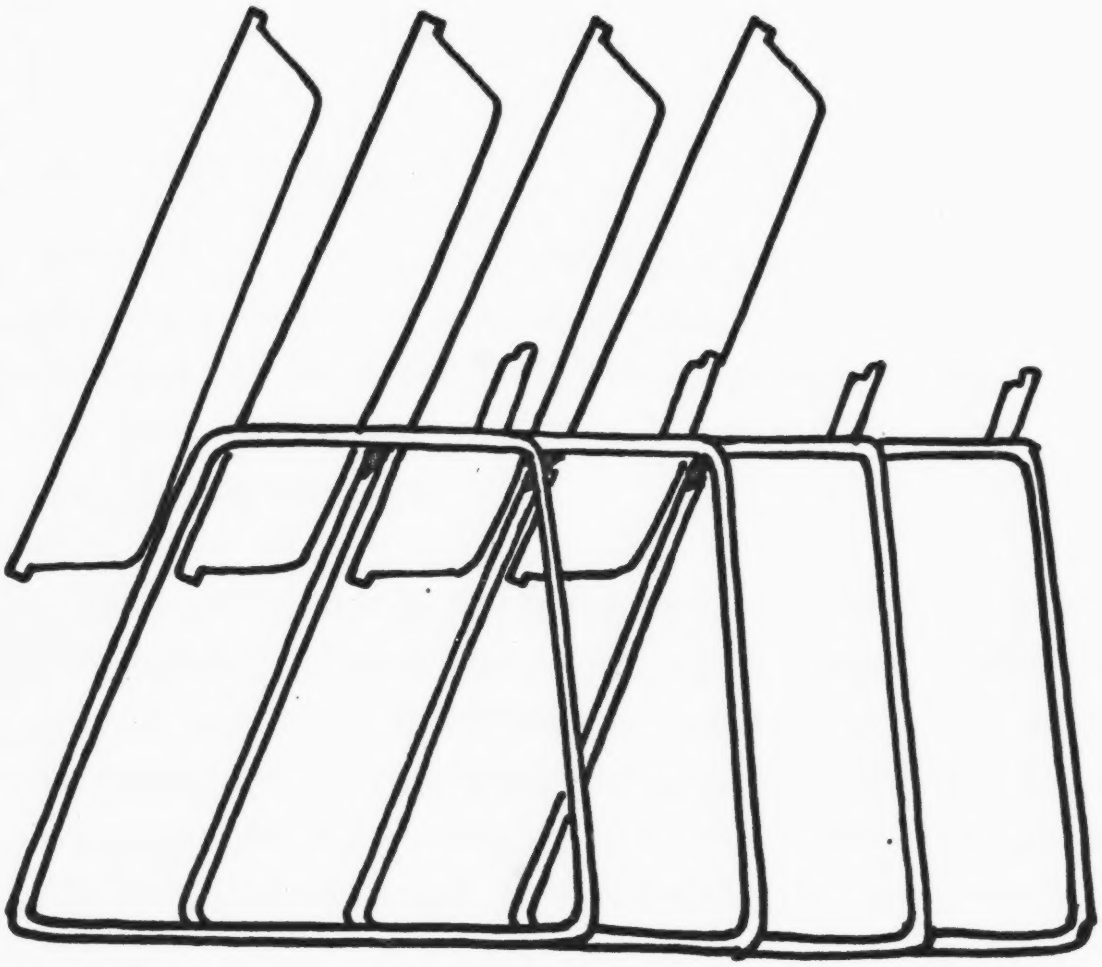


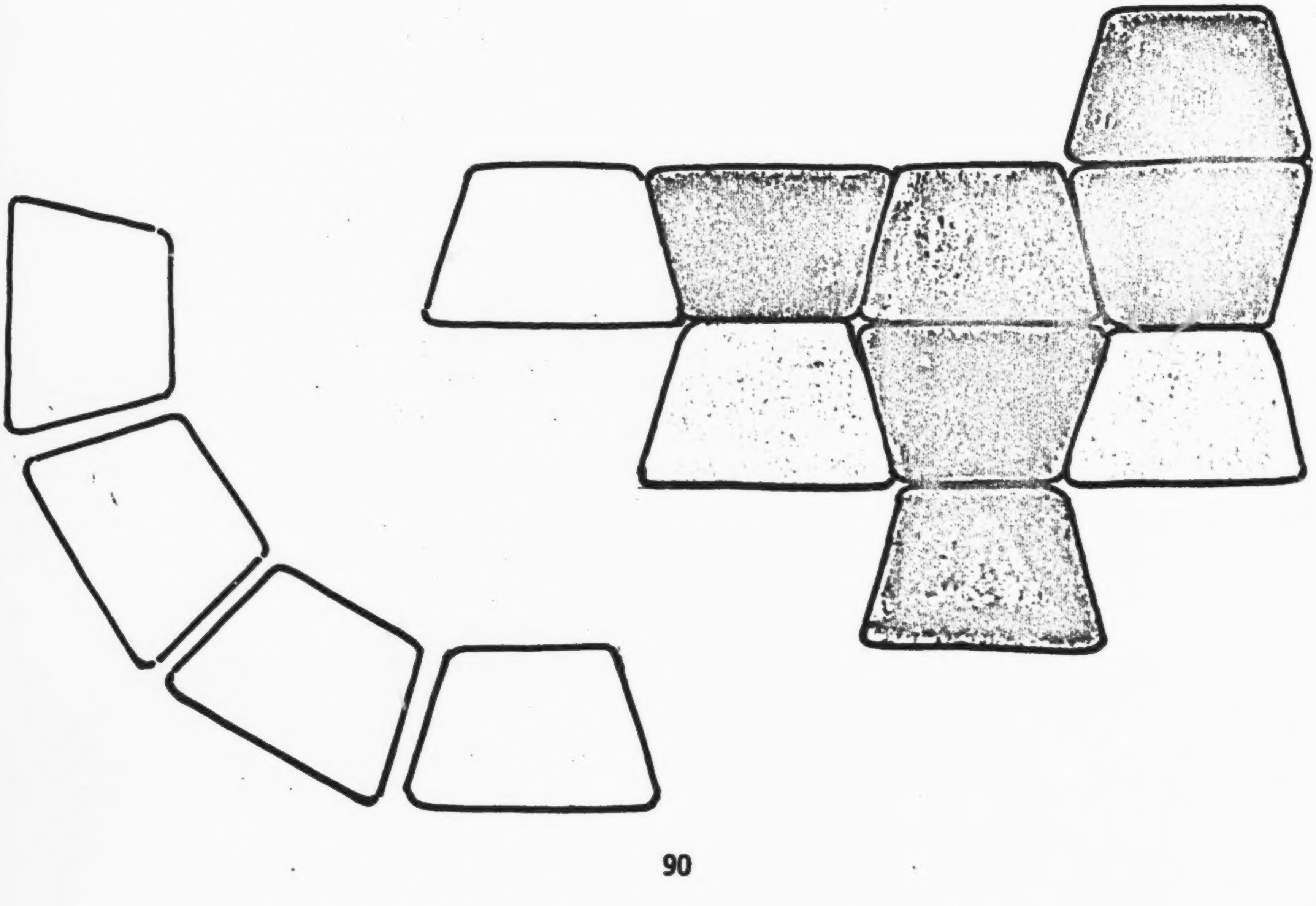
18. STUDENT DESK continued

Flexibility of usage assumes two important properties, storage and grouping. When activities require, the desks should be stored in the room in order to maximize free floor space. This should be simple to do and safe from accidents. The standard rectangular desk is suited for linear or right angle groupings, but it is less suitable for other grouping arrangements.

This desk can be stored by raising the storage bin and sliding the desks into each other in a nesting fashion similar to shopping carts. Safety devices hold the bins in position and prevent accidental opening of the desk top. The use of trapezoidal rather than rectangular desk tops allows for the shape of the normal work area and permits a greater variety of groupings suitable to the range of group activities. It allows for a large circle or a broad area of continuous surfaces, when desks of similar height are used, and a smaller number of desks may be grouped and joined with a covering unit to produce a circular conference table. Other groupings are left to the individual imagination.

18





19. STUDENT CHAIR

There are a variety of chairs currently on the market with different advantages and disadvantages. The criteria for this project include proper physiological support of seat and back, adjustability of seat height, storage facilities and ease of movement.

In this unit, seat width and depth are controlled by the anthropometric dimensions of the fifth grade child while the seat is curved in two directions--horizontally and vertically to conform to the anatomical structure.* Two back supports are used; the top support is used for orientation toward a far source with more weight on the back while the lower one supports the lower back in the balanced position of orientation toward a near task. This support is pivoted to allow for different statures and changes in position. The legs may also be adjusted to different positions to account for height variations in students. The same tubular leg system is light in weight and provides ease of movement. The leg adjustment is combined with the storage compartment and provides a handhold when moving the chair.

Chairs are most commonly used with the student desk, but they may also be used free-standing for discussion and group work or used in conjunction with other pieces of equipment.

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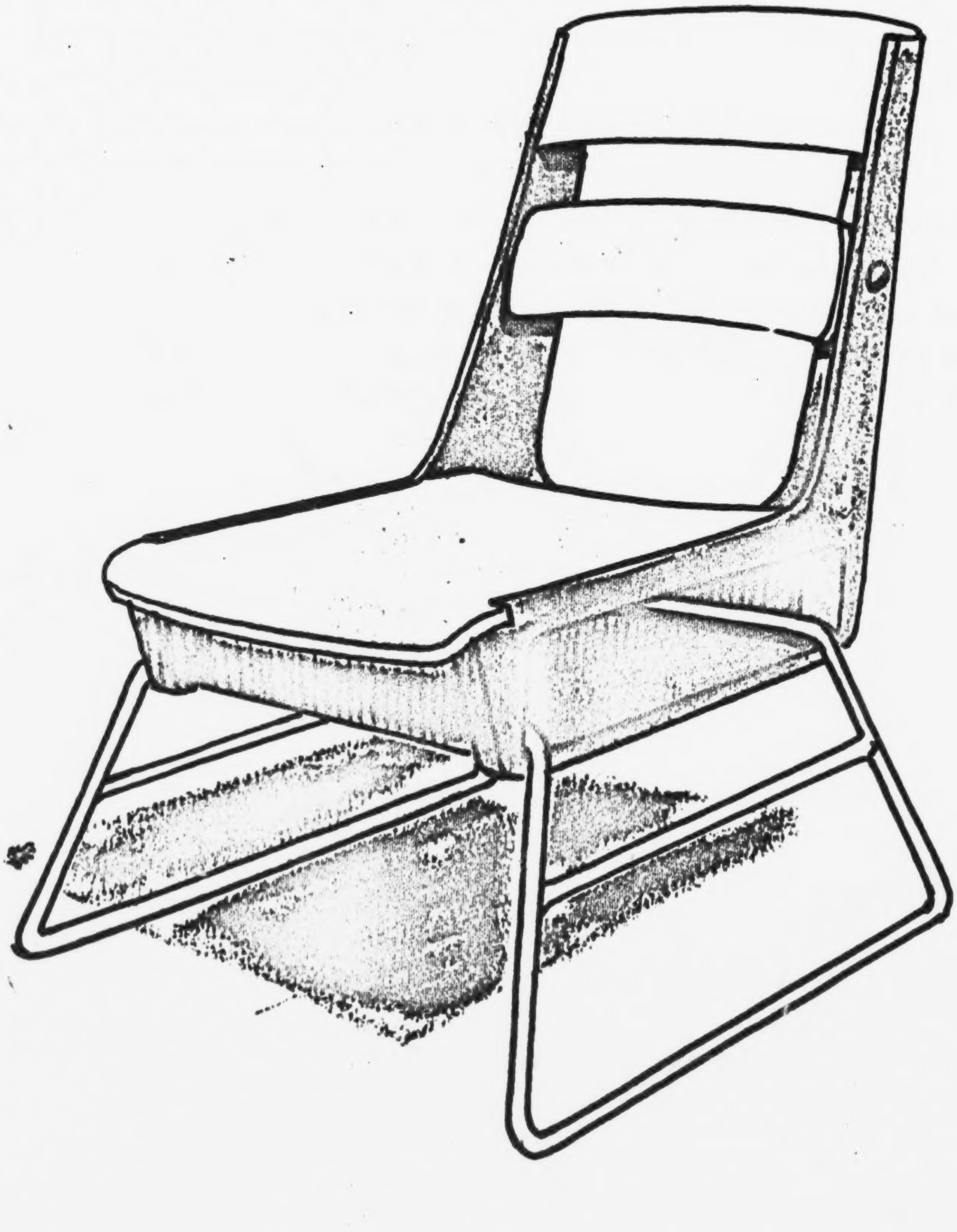
* W. Edgar Martin, The Functional Body Measurements of School Age Children (National School Service Institute, October, 1954).

19

CHAIR

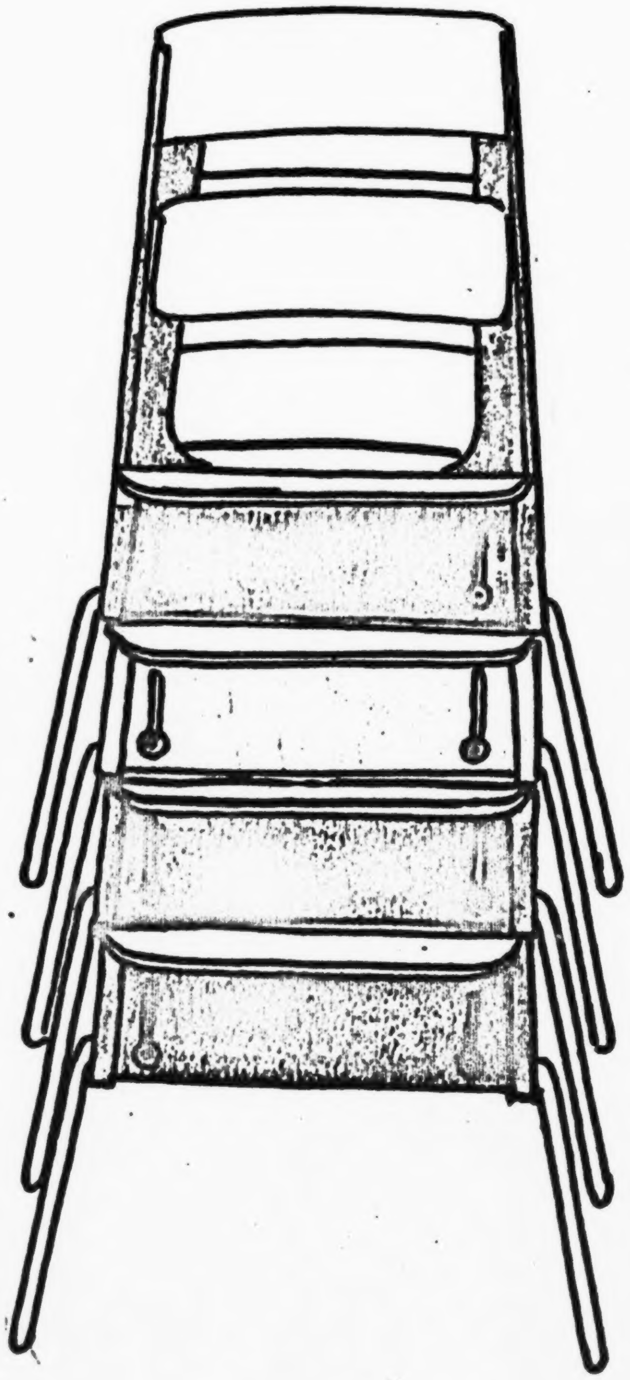


19. STUDENT CHAIR continued

Storage of student chairs is also important to accommodate different room functions. However, with this lightened piece of equipment it may be more conveniently stacked than nested. Again, safety factors are important.

Stacking of these chairs is permitted in the inclination of the tubular legs, although some provision should be made to insure firm seating between the stacked chairs and to prevent accidental toppling. Safety is possible with low stacks in which the chairs are light enough to be easily lifted and the stack is stable enough to be moved about the room. Both desks and chairs should use materials of different but harmonizing colors to facilitate recognition of furniture belonging to or adjusted for individual students.

19



IMPLICATIONS

THE FIFTH GRADE CLASSROOM

The preceding study has outlined the requirements for the environment of a typical fifth grade classroom. While this design is not complete due to gaps in the knowledge generated and the possibilities of alternative conclusions in the design synthesis, it should begin to indicate some of the variables available for design analysis and some of the provisions which may be made in the design of educational facilities. These criteria may serve as a guide in the design for specific situations and teaching methods.

The design emphasis has been flexibility and adaptability of usage with the provision of teaching space and equipment and furniture to facilitate this purpose. The teaching space which has been designed includes the advantages of flexibility in the specification of structurally free space and the use of semi-permanent and mobile units. This space arrangement attempts to break down the rigid isolation between classrooms and allows for team teaching and other joint activities which may add greater scope and variety to the teaching program. Other provisions such as the room orientation, use of clerestory and vision strips, and the placement and configuration of entrances should facilitate the use of the space.

Within the classroom the design has moved from the single general space concept used with rectangular and other room shapes toward a separation of the room space into functional areas, again to allow for a greater range and variety of activities, with particular attention to the concept of small group work on separate specialized projects throughout the room. This provides not only a greater scope of exploration but takes into account individual preferences and aptitudes. At the same time the use of mobile dividing units prevents the teacher from being limited by preconceived conceptions of the designer and encourages frequent regrouping and rearrangement of the areas.

Although the equipment which is specified is less generalized than that in frequent use, each unit is suited to multiple purposes and is designed to facilitate a number of different activities. One of the major aims was to increase the convenience and effectiveness of lectures and demonstrations. The seating arrangement and shape of the presentation area allow the students to be grouped without extending in unsatisfactory visual angles. The audio-visual unit extends the capacity of the standard blackboard by providing additional display and board space and is centrally located to avoid distortion from viewing at too great a lateral angle. There is immediate access to a projection screen for use with audio-visual aids or the overhead projector. Auxillary equipment is also important. The sink and demonstration cart allow for a greater range and convenience in scientific demonstrations while the map cart provides graphic materials which can be reached more conveniently and highlighted or annotated. The teaching station provides a less intrusive work surface which is more readily mobile and facilitates the frequent use of an overhead projector. Audio-visual and television carts allow this equipment to be more readily set up and used in a greater variety of situations.

In a similar fashion there is additional equipment to facilitate small group projects which can be readily set up in any combination in different parts of the room. The separate work areas and equipment also allow activities which would be difficult in a more general room. The provision of ample and varied storage place facilitate the use of more numerous and varied teaching and demonstration aids. In addition the specialized display facilities allow for the expanded use of models, exhibits and collections in the curriculum.

The environmental surround of the student is also considered in the provision of a variety of lighting and acoustical treatments. The luminous ceiling, clerestory, and vision strip provide for a coordinated system of glare-free light with a balanced distribution and spectral quality. The acoustical treatment on the walls, floor, and ceiling control reverberation and resonance; while the use of room speakers and earphones improve the quality of auditory presentations. Temperature, humidity, and air movement and ionization are controlled through an integrated atmospheric regulation system using double duct heating and cooling, humidity and ionization regulators, and the available air-circulation plenum to insure proper room circulation.

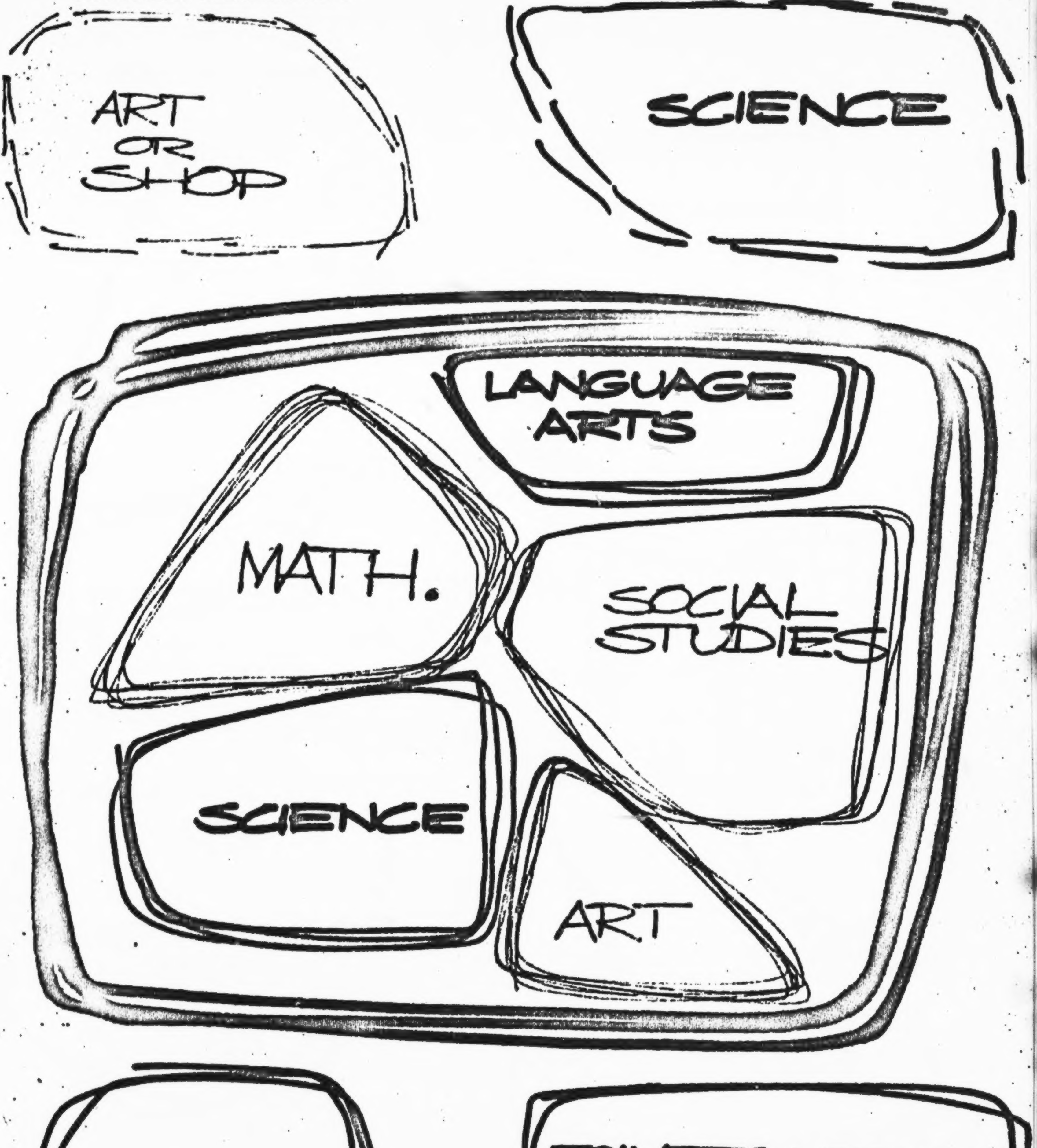
These are the results of the project, and while there are some unique suggestions and considerations and implications for future study remain as the critical product. Within this development a variety of approaches were taken to determine the educational and design criteria for a solution. This included taking into account a range of information on general educational principles, curriculum goals and subject matter; the types of educational activities and teaching methods which may occur in the classroom; and the general human factors and specific developmental requirements of the fifth grade child. Given this data, relationships were established and implications were developed in order to provide the environment best fitted to the individual situation. This included identification of educational specifications, analysis of different types of activities, and development of matrices of relationships between elements in the environment. An attempt was made to make a detailed measurement of the requirements and then to tailor the educational facilities to them. It is hoped that at least some questions and possibly some leads have been established in this endeavor.

A major discovery was that much of the information which might have been useful was unknown, namely, the teaching and learning processes and the effect of the environment. Much room remains for further research in this area. In addition while criteria were carefully developed from existing information, there is no guarantee that this is the best or even a better solution without the implementation and testing of the specifications.

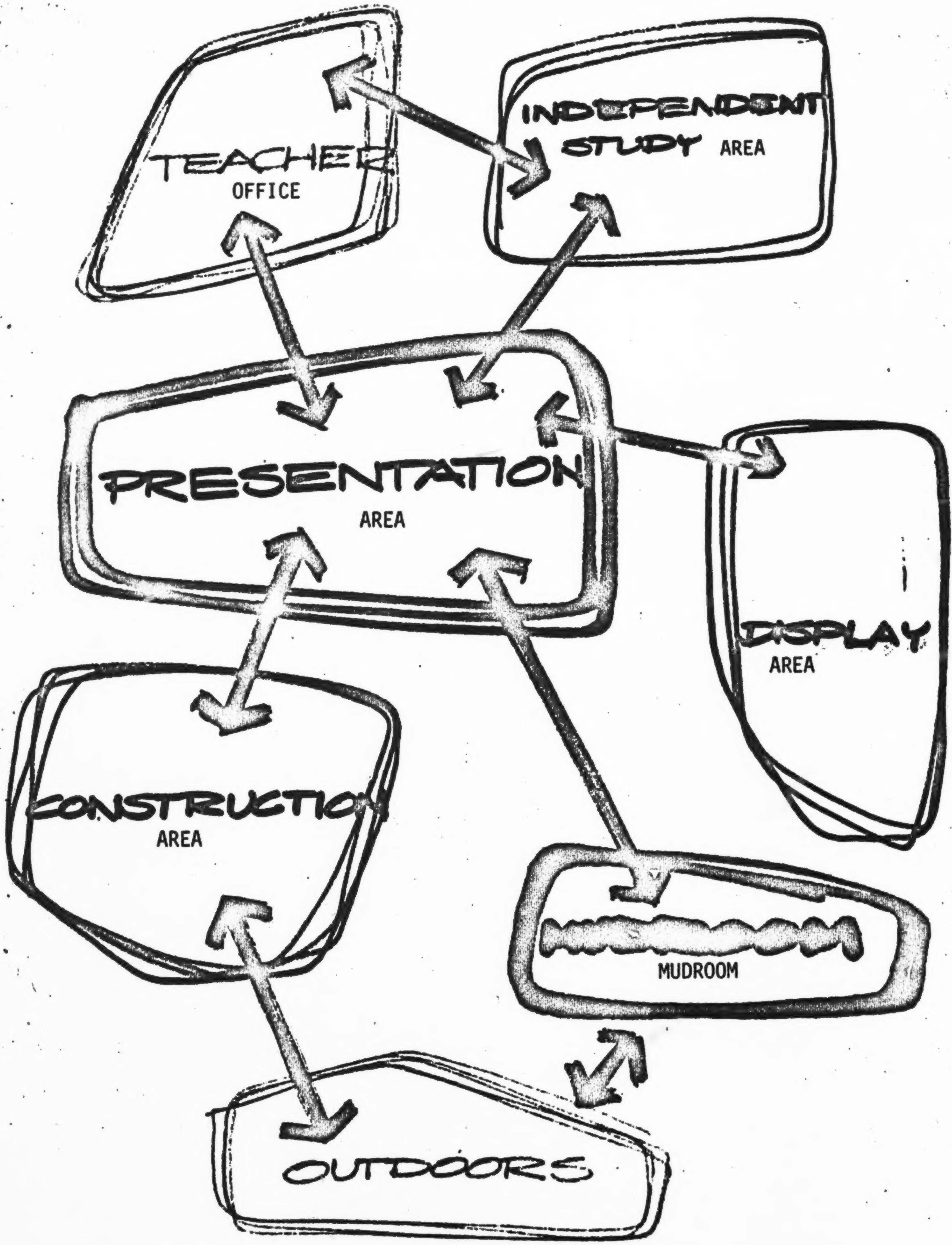
Finally, although this project was given broad resources of time and manpower, including a wide range of backgrounds and specialties, the problems which are met and the numbers of variables to be controlled are exceedingly numerous and complex. New tools and specialties will have to be developed to deal with problems of this scope in the depth which they deserve.

CURRICULAR, AREA AND EQUIPMENT RELATIONSHIPS

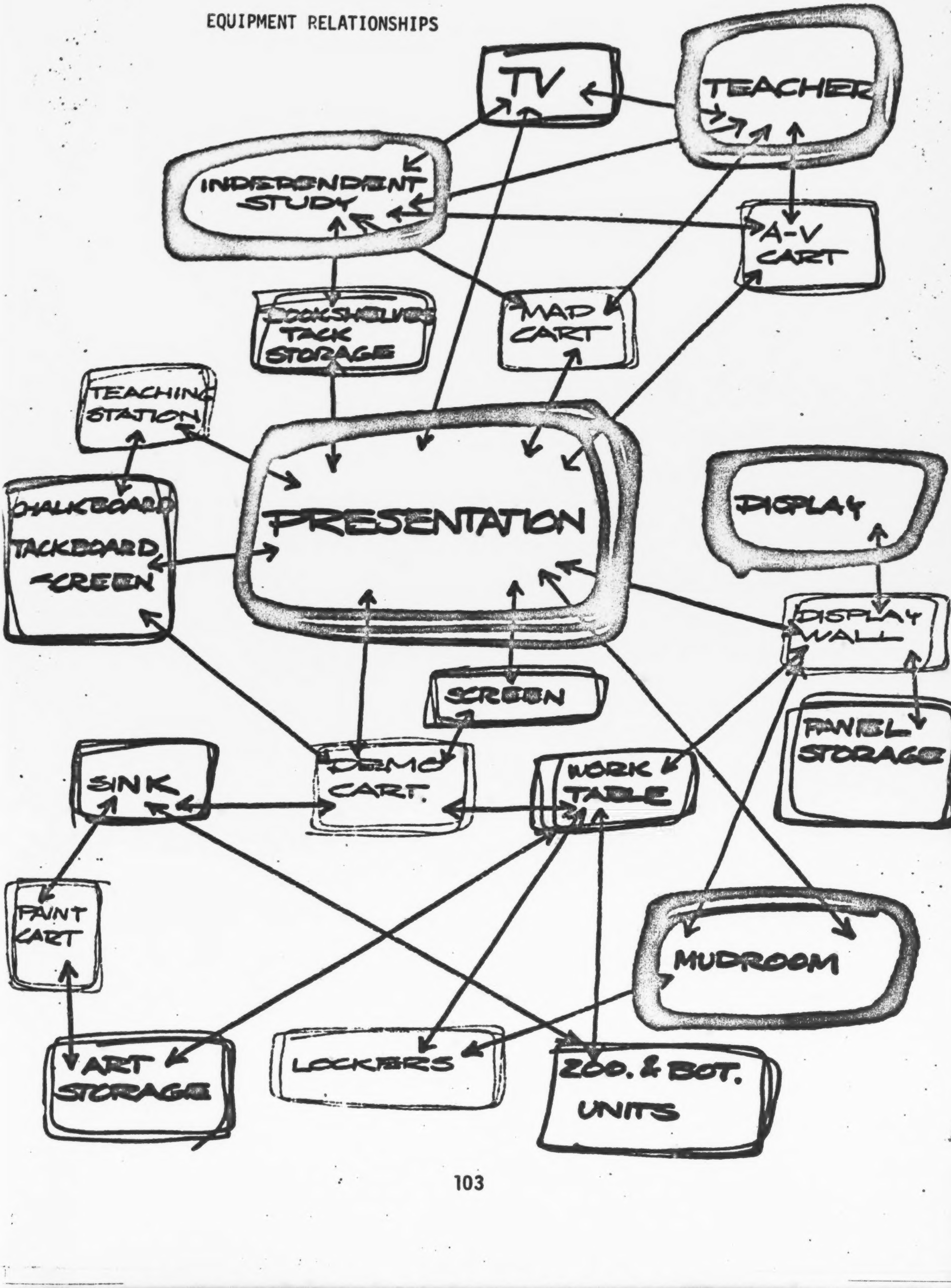
CURRICULAR RELATIONSHIPS


ART OR SHOP
SCIENCE
LANGUAGE ARTS
MATH.
SOCIAL STUDIES
SCIENCE
ART
MUSIC
TOILETS, LIBRARY
GYM
CAFETERIA

AREA RELATIONSHIPS


TEACHER
OFFICE
INDEPENDENT
STUDY AREA
PRESENTATION
AREA
DISPLAY
AREA
CONSTRUCTION
AREA
MUDROOM
OUTDOORS

EQUIPMENT RELATIONSHIPS


TV
TEACHER
INDEPENDENT STUDY
A-V CART
BOOKSHELVES TACK STORAGE
MAP CART
TEACHING STATION
PRESENTATION
DISPLAY
CHALKBOARD TACKBOARD SCREEN
DISPLAY WALL
SCREEN
PANEL STORAGE
SINK
DEMO CART.
WORK TABLE
PAINT CART
MUDROOM
ART STORAGE
LOCKERS
ZOO. & BOT. UNITS

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